

# The Influences on Innovation in Central and Eastern European Economies. Evidence from Poland and Czech Republic

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# The Influences on Innovation in Central and Eastern European Economies. Evidence from Poland and Czech Republic

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# Contents

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*Kazimierz M Kelles-Krauz*

# Thesis Abstract

Innovation is a driving force for firm's improved financial, organisational and competitive performance. Thus, firms are increasingly interested in better understanding the environments in which they operate, enablers that enhance and challenges that hamper their innovative activities. As firms search for innovative ideas, entrepreneurs are faced with decisions related to access to finance, embedding in 'network of collaborating actors', while at the same time navigating challenges and utilising available enablers to enhance firm's innovative capabilities. In this thesis we explore these themes and investigate three concepts: 1) entrepreneur's choices to diversify firm's funding base; 2) firm's decisions to collaborate along its supply chain and 3) manager's awareness of enablers and challenges to innovation. The core of this thesis is built on three papers which each explores one of these concepts using unique survey data from Small and Medium Enterprises in Poland and Czech Republic. We adopt multivariate analysis and draw implications from managerial and policy perspective. From the findings, we build a link to finance supply and demand literature and add a novel factor (*diversified funding base*) to the literature on influences of innovation. We observe curvilinear relationship as firm over-diversifies its funding base and we assess its impact on innovation. In the second paper, we connect our study to supply chain literature and explore firm's decisions to embed into upstream or downstream associations. Our findings confirm dynamic relationships in supply chain relationships and we discuss impacts of over-engagement in certain associations. Finally, we recognise that entrepreneurial choices are influenced by manager's awareness of certain enablers and challenges to innovation. We investigate these in our final paper and discuss certain managerial and policy recommendations. The results of this study add to the literature on sources of innovation and include additional measures in which innovation can be enhanced or optimised.

**Keywords**: Innovation, Small and Medium-sized Enterprises, Central and Eastern European Economies, Funding Diversification, Co-operation, Supply Chain, Challenges & Enablers to Innovation,

# 1. Introduction

## 1.1. Chapter Introduction

SMEs are the driving force for the economy employing c93m people, representing c67% of total workforce and amounting to c99.8% of all enterprises in the EU-28 (European Commission, 2017a). EU official categorisation defines SMEs as firms that employ fewer than 250 persons, have turnover less than EUR 50m and/or annual balance sheet of maximum EUR 43m (European Commission, 2015). The European Commission SME definition standardises the approach towards EU funds accessibility but also enables to categorise firms according to unified definition across EU. Throughout this research, we adopt the SME definition in line with this EU recommendation 2003/361[1].

Innovation is a driving source for sustainable competitiveness and socio-economic growth of economies (Szczepanska-Woszczyna, 2014; OECD, 2015b). Cantwell (2003, p. 18) describes competitiveness as the *"form of creation of the locally differentiated capabilities needed to sustain growth in an internationally competitive environment"*. Increased innovative activity drives the competitive advantage and market performance of the company (Gunday *et al.,* 2011; Hausman and Johnston, 2014), while differentiated capabilities are at the core of the innovative output leading to greater competitiveness (Cantwell, 2003). In a globalised economy not only corporations compete between themselves, but territories are faced with increased competitive pressure as well (Camagni (2002). In this way, the pressure for Small and Medium Enterprises (SMEs) to innovate and adapt to changing globalised environment is even greater (Gunasekaran *et al.,* 2011).

The focus of this thesis is to explore influences on innovation for Polish and Czech SMEs. There were few attempts in understanding the driver factors of innovation in the economies of Central and Eastern Europe, however few of them focused on linking several factors such as financing, co-operation, manager's perceptions to innovation into one coherent study on innovation within Central & Eastern European context. In this thesis we explore several concepts impacting innovation and draw managerial and policy implications. Firstly, we build a link to finance literature and investigate *diversified funding base* as a novel construct

[1] EU recommendation 2003/361 is defining the SME definition as presented by the European Commission: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition/

that may impact firm's innovative performance. Secondly, we recognise that firms are increasingly embedded in co-operative arrangements, hence *breadth* (number) or *intensity* (strength) of their associations may impact innovative performance. Finally, the environments in with SMEs operate require entrepreneurs to face certain challenges and take advantage of enablers that may support innovative activities. We discuss these in our final paper and draw practical and policy recommendations. In this way, the study contributes to the discussion of influences on innovation by adding new concepts (e.g. diversified funding base) or exploring in more detail elements which attracted some research debate, however with limited focus on Central and Eastern European economies (e.g. collaboration along supply chain). In addition, this study provides a further exploration of areas related to level of "*embeddedness*" and discusses impacts on firm's innovation levels when relational engagement (e.g. in funding diversification or supply chain collaboration) is beyond certain levels. The findings lead to interesting results and future studies could explore potential trade-offs (e.g. between various finance means within funding diversification mix) to further accelerate or optimise firm's innovative capability. Subsequent discussion of enablers and challenges to innovation provides further insight into areas where firms are hampered or supported in achieving innovative results. These findings are then discussed in the context of managerial and policy recommendations.

This thesis is focused on two markets within the Central and Eastern Europe (CEE) region, Poland and Czech Republic. The CEE region encompasses Central Europe, Southeast Europe and Eastern Europe formerly under communist influence. Jacoby (2010) notes that the EU enlargement in May 2014 has been perceived as a win-win situation for former and new EU Member States, some of which being from CEE region. The EU accession resulted in lowering of borrowing costs, boosting trade and stimulation of former EU members in adoption of more liberal policies to deal with increased competition from the new Member States (Jacoby, 2010). SMEs from the new Member States (EU-12) account for ca. 20% of all SMEs in EU-27, while remaining 80% belong to remaining old Member States (Mateev *et al.*, 2013).

While, CEE region experienced significant growth over the past three decades, Groh and Lichtenstein (2011) argue that region has not yet fully finalised the transition from central planned to market-based economy. Some of the innovation metrics (e.g. collaboration, number of SMEs innovating, etc.) lag as compared with the EU averages. In addition, both markets demonstrate a relative high dependence on foreign-owned lending institutions

compounded with relative limited external financing options as compared with more developed markets. Thus, in the context of CEE markets, the contribution of this thesis adds to the debate on factors that support the journey towards a more innovation-led economies. Economies which are based on knowledge enhancement, innovation creation (rather than innovation absorption from more advanced markets) and managerial improvements to strategies and entrepreneur's behaviours to create a more conducive innovating environment. Despite of significant improvements in governance, methods how firms operate and development of financial industry, the CEE region still shows a smaller GDP per capita compared with Western Europe (Groh and Lichtenstein, 2011). Furthermore, the CEE region is not homogenous in its social and economic performance (Aidukaite, 2011). Among all CEE countries, the four markets (usually named as *Visegrad* countries), Poland, Czech Republic, Slovakia and Hungary over-performed in economic growth the more rural South East Europe and Baltic nations (Aidukaite, 2011). In CEE region, Knight and Webb (1997) observed that specifically both Poland and Czech Republic achieved spectacular improvements in GDP growth compared to all other CEE markets. For instance, the GDP growth in Poland over the period 1989-2013 was at c4% annually (Gomulka, 2016), while for Czech Republic the economy grew at average of c2% p.a. between 1991-2017[2]. This was achieved even when both markets struggled in their early years of transition with significant inflationary environment with inflation rates at 9,6% and 27,8% in 1995 for Czech Republic and Poland respectively (Stoica and Damian, 2013). Knight and Webb (1997) notes that a significant part of the success was attributed to the level of foreign direct investments going to both markets which helped the domestic capital supply.

Why Poland and Czech Republic were selected from this cluster of nations for this research? Both markets show important similarities in the CEE region, for instance Poland and Czech Republic both introduced radical reforms immediately after the change of the political systems early 1990s (Jahn and Mueller-Rommel, 2010). Poland and Czech Republic are the biggest economies in CEE region in terms of GDP[3]. Poland more than doubled its GDP per capita since 1989, outperformed all global peers (incl. so called *Asian Tigers*) and was the only European country to avoid 2008/09 financial crisis recession (World Bank, 2016). Poland and Czech Republic rank as 23rd and 45th biggest economies in the world respectively

[2] World Bank Indicators (https://data.worldbank.org/indicator)
[3] World Bank Indicators (https://data.worldbank.org/indicator)

outperforming number of European peers[4]. In addition, in Poland and Czech Republic the SME sector (relevant for this thesis) grew more significantly than in any other CEE market and contributed substantially to the GDP (Winiecki, 2003). In addition, both markets Poland and Czech Republic have made significant progress to liberalise, stabilise and privatise state owned enterprises what contributed to the expansion of the private sector (Winiecki, 2003). While the relevance of both markets in the global economy increases and innovation-led growth becomes progressively more important, the themes of this research have yet found limited interest in the academic discourse. Thus, the aim of this thesis is to provide more context in which Polish and Czech SMEs innovate, explore influences on innovation by adding new concepts (e.g. funding diversification, breadth and depth of co-operation in CEE context), and hence contribute to the innovation studies on Central & Eastern European firms.

The core of the thesis is comprised of three self-contained academic papers, each in an advanced draft form due for submission to ABS-4 grade journals shortly. Each paper is set out to include all relevant sections for journal publication, e.g. introduction, literature review, methodology, results, discussion, conclusions and areas of future research. Each paper develops different statistical analysis and draws on different multi-dimensional and multi-scalar constructs defined within respective papers. While there is some cross-over between the papers, most notably in the description of the SME sector in Poland and Czech Republic or survey approach, each includes a dedicated and complete discussion of the relevant literature and aims for each paper.

This thesis has a following structure. The aim for the introductory chapter is to provide context in which SMEs from Poland and Czech Republic operate. This includes both the background on Polish and Czech SMEs and discussion on innovation levels and challenges within the sector. The objective of the chapter is to contextualise the three papers within the thesis and to provide rationale for each individual paper. In the following section, background and methodological approach is discussed, while some specific aspects are elaborated in more detail within respective papers. Then, each paper is presented (Sections 3-5) after which, Section 6 brings conclusions together, summarising the contributions from each paper into one coherent study. Lastly, we discuss areas for future research to build on findings from this research. The references are contained within each respective paper,

[4] World Economic Outlook Database. International Monetary Fund (2018).

however references used for sections outside of core papers are listed in the reference section at the end of this thesis.

## 1.2. SMEs in Poland and Czech Republic

Similar to European characteristics of SME market, SMEs in in Poland and Czech Republic, account for 99.8% of 'all non-financial business economy' (European Commission, 2017a and 2017b). However, the structure and setting has been significantly influenced by the historical developments of the second half of 20th century. Post Yalta Conference decisions in 1945, communist governments were installed in Poland and Czech Republic, a move that has not been independently desired by both markets. Both countries remained under the sphere of communist influence for the next five decades which soon after the World War II started the economic re-organisation focused around central planning. This had an impact on how firms operate and innovate, especially as private ownership and entrepreneurship was banned throughout the period. In addition, the market was dominated by large organisations which could benefit from the state aid in case of financing problems.

The economic situation of CEE region has materially changed after the end of communism. Not only the mentality but also the approach to the business changed significantly. Before the economic reforms of 1989/1990 most of the socialist countries struggled to maintain their economic balance and the corporate sector mainly relied on inefficient state-owned enterprises (Sachs, 1996). According to Kennedy (1997) there are two factors, excessive state control over the economy and administrative price setting, which had a negative effect on pre-1989 economic activities in socialist countries. Because of these two factors many socialist countries showed a high reliance on heavy industry, high industry concentration levels, high degree of non-economic activities of managers and frequent shortage in supplies (Kennedy, 1997). The impact of fifty years in central planning was destructing for some economies. For instance, before World War II, Czechoslovakia was among ten most industrialised countries in the world in terms of industrial production, position that significantly deteriorated during 1945-1990 where central planning and allocation of resources led to significant reductions in productivity (Sujan and Sujanova, 1995).

The transformation of 1989/1990 introduced a new wave of changes across fiscal / monetary / international / governance levels aligning it closer to market economies. In the early stages of transformation, the changing role of entrepreneurship and importance of entrepreneurs

has been critical as environments in which firms operated and market institutions were still imperfect (McMillan and Woodruff, 2002). In addition, the transition process influenced the formation of new market-oriented SMEs which benefited from the privatisation process and deterioration of larger inefficient companies (Hutchinson and Xavier, 2006). The early years in a newly developing market-led environment were challenging for most SMEs due to inflation and administrative inefficiencies. In Poland and most other CEE markets the reforms of 1989/1990 have contributed to the modernisation and industrialisation of the markets. Brandt (2018), in an OECD study, notes that Poland's economic development has been mainly attributed to productivity increases and absorption of foreign technology. However, many CEE markets grew at a different pace mainly due to the quality of the state and legal institutions (Kowalewski and Rybinski, 2011). The end of communist era marked a rapid growth in the number of new SMEs which took advantage of the lack of consistent legislation and taxation while being able to respond faster to the opportunities created within the new market environments (Hashi and Krasniqi, 2011).

As most of the SMEs represented newly created firms, the access to financing demonstrated a significant challenge. Nofsinger and Wang (2011) observed that new firms (or start-ups) face difficulties in accessing funds from institutional investors if new product is developed, hence need to rely on private investors to fund their projects. Rraci (2010) showed that SMEs in emerging economies face more problems in accessing funds than larger companies or foreign owned firms. That is why the EU enlargement in 2004 served as a significant milestone in shaping the environment in which the SMEs operated. The institutional funding via convergence programmes (e.g. supporting environmental or infrastructure projects) has become more accessible to SMEs reducing their reliance on funding from private investors. However, the EU enlargement brought a significant pressure on competitiveness among enterprises and innovative character of their products. The free flow of capital, workforce and reduced trading restrictions resulted in more condensed and competitive market mainly due to international competition. While new opportunities arose when EU market enlarged, the SMEs from CEE region were faced with new challenges which highlighted the importance of innovations and investments in R&D to sustain competitiveness.

## 1.3. SME Innovation in Poland and Czech Republic

European Scoreboard 2018 (European Commission, 2018a) categorises Poland and Czech Republic into *Moderate Innovators* group with innovation performance being below the EU average. However, between 2010-2017, innovation performance improved for Poland (+3.2%) and declined for Czech Republic (-2.9%; European Commission, 2018a). Historically the performance improvement for less innovative markets was faster, however Innovation Scorecard published by European Commission (2018) suggests that convergence speed may now not necessarily relate to the current innovation level by country but may be dependent on other factors affecting innovative activities.

Focusing on Polish firms, the improvement in innovation performance between 2010-17 is likely attributable to the increase in *innovation friendly environment* (+88%) within same analysed period (European Commission, 2018a). However, despite increase in innovation supporting environments and high share of workforce with tertiary education, Polish SMEs show a considerable decline in collaboration metrics between 2010-2017 period with innovating SMEs collaborating representing just 23% in 2017 vs. 52% in 2010 of EU average (European Commission, 2018a). Venture capital financing and R&D expenditures in public sector are also below 50% of EU average highlighting the challenges of Polish SMEs with accessing finance to support innovative activities (European Commission, 2018a). Furthermore, Poland's R&D spending as percentage of GDP is at 0.9% in 2013 and is well below EU average (European Commission, 2016). The number of new product and process innovations also lags below EU average, with c23% of Polish companies being recognised as innovative enterprises as compared with c40% for Czech Republic (European Commission, 2016). To enhance the innovative performance of Polish firms, Polish Ministry of Development launched in 2016 a 'Scale UP pilot programme' to support development, incubation and acceleration of start-ups (European Commission, 2017b). This is one of the governmental policies to support the SME innovation and leverage their potential with the experience of larger or even state-owned enterprises which in effect would lead to sustained collaborative activities within the economy (European Commission, 2017b).

In Czech Republic, European Commission (2018) notes the strong performance of firm investments in R&D activity (c116% of EU average) and international scientific publications (244% of EU average). In terms of collaboration, innovating Czech SMEs show a better performance than Polish SMEs with levels at 88.6% of EU average (European Commission,

2018a). Similar to Poland, Czech SME sector is struggling with access to finance, with R&D expenditures in public sector and venture capital financing being at 85.8% and 6.1% of EU average in 2017 respectively (European Commission, 2018a).

## 1.4. Thesis aims and rationale for each paper

Earlier section has noted the context in which SMEs from Poland and Czech Republic operate and innovate. With the growing importance of SME sector, there is a need to better understand influences on innovation in both markets, especially focusing on entrepreneurial choices for certain managerial actions to promote innovative activities. The entrepreneurial choices are at the core of our study and herein lies the purpose of this research and rationale for each of the papers. Three key themes have been selected for greater focus, namely: 1) entrepreneurial choices to diversify firm's funding base; 2) entrepreneurial choices to broaden or intensify supply chain up / downstream relationships; 3) SME manager's assessment of how innovation is either enabled or challenged by various managerial and non-managerial factors. The three papers provide for an in-depth discussion of these issues and contribute to both managerial and policy recommendations.

The thesis itself has several goals (in addition to the goals of each paper), which are as follows:

- Introduce *diversification of funding base* as a new concept in the study of innovation influences within the context of SMEs;
- Assess firm's co-operative activities and their impact on product and process innovation
- Consider the awareness and perceptions of SME managers regarding challenges and enablers to innovation;
- Contribute to the policy discussions regarding areas supporting innovative activities for SMEs in Poland and Czech Republic;
- Explore original survey data to SMEs from Poland and Czech Republic where there has been limited research attention so far in the analysed fields

### 1.4.1. Paper One: Diversification of funding base

*"Diversification of Funding Base and its Impact on SME innovation: Evidence from Poland and Czech Republic "*

This paper is in an advanced draft form prepared for a submission to one of the ABS-4 journals. The latest version is contained herein (Section 3).

Number of prior studies focused on firm's challenges in accessing finance and resultant implications on innovative performance. Different finance providers may have varying demands towards the returns, payback period or risks undertaking by a borrowing firm. Hence, appetite to conduct innovative projects (with often uncertain outcomes) may vary dependent on the number or specific risk / return expectations of the lender. In addition, firm's innovative capability is influenced by the source of external finance and access to differentiated sources of financing may support innovative capabilities of young, privately owned firms (Smith, 2013). However, ability of funding sources is constrained by information asymmetry, availability of funding instruments (especially relevant in CEE economies context) and funding costs.

So, why should SME managers consider finance diversification? For instance, OECD (2015a) argues that access to broader finance sources reduces the systemic risks in case financial markets move in adverse way. Firm's may also tailor their financing towards specific organisational life stages and once firm's needs change, the source of funding requires adjusting (Bravo-Biosca, 2014). Entrepreneur's decisions to broaden funding structure to support innovation may be influenced by the search for optimal capital structure, recognising either funding source trade-offs and pecking order theory (Bravo-Biosca, 2014; Elitzur and Gavious, 2003; Hall, 2002; Myers, 1984; Briozzo and Vigier, 2012). Hence the entrepreneurial choices to broaden the financing mix is dependent on both aspects, supply side (availability and accessibility of broader set of finance instruments) and demand side (entrepreneurial decisions to diversify recognising the return demands from various lenders).

Thus, we believe there is a dynamic relationship between firm's capital structure and corporate strategy. In our thesis we argue that funding diversification is another factor which may influence SME's innovative capabilities. With broader set of funding instruments available, firms move from pure operational / day to day expenditures and focus on more future-oriented innovative ideas. However, we argue that at some point, where over-diversification of finance means occurs, firm's innovative capability may be impacted.

Resource allocation decisions may not be as effective as when capital is scarce or borrowing firm may struggle to satisfy the needs of capital providers often pulling in different directions. Therefore, in this thesis we explore the relationship between finance diversification (incl. effects of over-diversification) and its impact on innovation.

In summary, the goals for the first paper are as follows:

- Introduce a concept of "*Diversified Funding Base*" as novel factor that may affect firm's innovative capability which should be considered when finance optimisation decisions are made;
- Explore whether *over-diversification* in finance sources impacts innovation and provide managerial and policy implications;
- Explore differences between firms with low, medium and high funding diversification and their relative innovative capabilities;
- Address difference between product and process innovations and consider how these measures are impacted by "*Diversified Funding Base*";

### 1.4.2. Paper Two: Intensity and breadth of inter-firm's co-operation

*"Intensity and Breadth of Interfirm Co-operation and its Impact on SME Product and Process Innovation. Evidence from Poland and Czech Republic"*

This paper is in advanced draft form, having been written for submission to a leading ABS-4 grade journal in supply chain management (Section 4).

This second paper explores concepts of *intensity* and *breadth* of inter-firm's co-operative activities. In this study, breadth is referred to a number of co-operative relationships (Laursen and Salter, 2006) and depth represents intensity of the engagement with each partner (Laursen and Salter, 2006; Keupp and Gassmann, 2009). The paper analyses dynamic relationships within the 'network of actors', focusing on supply chain up and downstream associations and their impact on product and process innovation. This is especially important as SMEs play an increasingly important role in value chain creation, thus inter-firm collaborations, in progressively more interconnected economy, may act as a catalyst to firm's innovative performance (Potocan and Mulej, 2009).

This paper builds on earlier paper on funding diversification as it considers further elements in entrepreneurial choices to support innovation. While earlier paper on funding diversification focused on entrepreneurial choices to broaden firm's funding base, the second

paper assesses firm's decisions to embed into collaborative activities. By doing so, we also explore the concept of over-embeddedness in networks, where over-intensive connectedness may result in diminishing returns from R&D investments (building on earlier research of Molina-Morales and Exposito-Langa, 2012; Gebreeyesus and Mohnen, 2013; Tomlinson and Fai, 2016).

This research aims to add to the literature a systematic and simultaneous analysis of both constructs, *breadth* and *depth* of relationships, in the context of dyadic up and downstream supply chain relationships, especially for SMEs from CEE economies. This is novel as earlier literature has either focused on more developed markets or addressed embeddedness in one-stream supply chain associations. Building on earlier research on funding diversification, the exploration of firm's collaborative activities allows us to assess entrepreneurial choices in the context of Central & East European supply chain management associations.

The goals for this second paper are as follows:

- Explore the *depth* of association in up / down stream associations and their impact on product / process innovation;
- Explore the *breadth* of association in up / down stream associations and their impact on product / process innovation;
- Assess *over-embeddedness* in either up or downstream supply chain relationships and their impact on product / process innovation;
- Discussion of results in the context of Central & East European supply chain innovation;

### 1.4.3. Paper Three: Challenges and enablers to innovation

*"Challenges and Enablers to Innovation within Small and Medium Enterprises in Central and Eastern European Economies. Evidence from Poland and Czech Republic"*

This paper is in advanced draft form, having been written for submission to a ABS-4 grade journal (Section 5).

Building on the themes of Paper One and Paper Two, such as entrepreneurial choices to diversify firm's funding base, broaden or intensify firm's collaborative activities, the Paper Three analyses specific challenges and enablers to innovation. This allows to connect earlier

papers in a coherent story, in which we explore entrepreneurial choices (diversification, collaboration) and confront them with firm's challenges or enablers to innovation.

Understanding of the environment in which SMEs operate helps to better address what supports and what challenges their innovative activities. This final paper builds a link to strategic management literature and argues that firm's innovative performance is influenced in significant way by managerial strategies and practices supporting innovative thinking. Recognising there is no unique or exhaustive list of innovation challenges and enablers, this paper addresses certain topics in managerial behaviours or attitudes that promote or constrain innovation.

The goals for this final paper are as follows:

- Explore additional, previously not explored challenges and enablers and discuss their relevance for SMEs innovative capabilities in CEE economies;
- Investigate firm's awareness to selected challenges and enablers and draw a link with strategic management literature for possible managerial recommendations;
- Discuss the results in the context of Central & East European SME innovation literature and explore areas for policy recommendations to either mitigate or strengthen certain activities and behaviours;

## 1.5. Significance of the research in the context of CEE economies

The CEE region consists of markets in Central Europe (Poland, Czech Republic, Hungary and Slovakia), Baltics (Lithuania, Latvia, Estonia), Eastern Europe and South-Eastern Europe. A further sub-classification of CEE region can be made based on their accession to the EU with first wave of eight countries joining in 2004 (Poland, Czech Republic, Lithuania, Latvia, Estonia, Slovakia, Hungary, Slovenia); second wave in 2007 (Romania and Bulgaria) and third wave in 2013 (Croatia). According to World Bank[5], nine out of eleven CEE countries within the EU are considered high-income economies, and two (Romania and Bulgaria) belong to the upper-middle income economies category.

The CEE region experienced a significant growth which was attributed to factors such as foreign direct investments, funding from the EU, lower labour costs and improvements in export dynamics (McKinsey Global Institute, 2018). After the EU accession, firms from the

[5] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

CEE region experienced productivity increases due to better macroeconomic stability, trade, globalisation, improved governance, investments in technology, communications and labour skillset (World Bank, 2008). However, as the drivers of growth from the past three decades are beginning to deteriorate, the CEE region needs to re-define its growth strategy (McKinsey Global Institute, 2018). These new strategies and priorities need to be implemented to sustain the competitiveness of CEE region and to increase its relevance in the world economy (Krajewski, 2014). The core element of these strategies will relate to the development of economies that are driven by knowledge-intense industries, highly skilled workforce and innovation-oriented activities (Krajewski, 2014). Thus, the factors discussed in this thesis are significant for CEE policy makers and CEE managers in understanding influences of innovation and strategies to effectively support it.

Radosevic (2017) mentioned that: "*The future growth of Central and Eastern Europe (CEE) depends on upgrading technology, exporting and coupling domestic technology efforts while improving their position in global value chains"* (Radosevic, 2017, p. 1). Our thesis aims to address above areas by studying two most advanced economies in CEE region and focusing on influences on innovation in three areas such as financing, collaboration in supply value chain and management strategies. As Radosevic (2017) noted, 2008 crisis impacted CEE economies and reduced their speed of convergence with more developed regions of the EU. This suggests that the strategy for growth and convergence needs to change and a new approach needs to be developed for CEE economies to place more attention on innovation agendas, productivity enhancement, export and technological upgrading (Radosevic, 2017, p.2). Radosevic (2017) also suggests that CEE economies will need to focus on improving their management practices as they move from creating incremental innovations, process and cost-oriented enhancements and start engaging in new breakthrough product innovations. Thus, exploring financing diversification, collaboration, management barriers and enablers to innovation will address the most important areas of influences to innovation in CEE region. However, before that, it is important to discuss the reasons why Poland and Czech Republic have been selected from the cluster of CEE economies for this study.

First, both Poland and Czech Republic have undergone significant transformational reforms post 1989. Dana and Ramadani (2015) recognised the importance of both political and economic transition which is required to advance from state-socialism towards a liberal economy bound by civil society, democracy and market-led principles. Both markets have successfully implemented reforms, created investment-friendly environments and stimulated

entrepreneurial spirit. While, the past three decades since the end of communism have been extraordinary for the Polish economy (e.g. continuous growth in GDP, the only EU country to avoid 2008 financial crisis, unemployment levels below 5%, etc.) the focus now needs to be placed on supporting innovation to further sustain and accelerate economic growth (World Bank, 2016). Similarly, for Czech Republic, economic indicators and speed with which the market economy transformed have been robust and Czech Republic is now classified as an Advanced Economy by International Monetary Fund[6]. In addition, in 2019 World Bank[7] classifies both markets as OECD high-income economies (with the Gross National Income per capita criteria of USD12,056 or beyond). However, despite significant economic improvements, the process of catching up with more developed markets is not concluded and European Bank for Reconstruction and Development (EBRD) recommends a more profound focus on knowledge-intensive industries to support innovation and human capital (Breznitz and Ornston, 2017). This is particularly important for CEE economies as they benefited from foreign-direct investments and accessible EU-funds since the EU accession in 2004 (Breznitz and Ornston, 2017). In CEE region, a shift from economic growth driven by a low production costs, availability of human resources and EU funds towards a growth based on productivity, innovation and human capital requires investments in education and knowledge-intensive industries (Breznitz and Ornston, 2017).

Second, Poland and Czech Republic have been selected from the CEE cluster of economies as they demonstrate comparable dynamics in R&D investments intensity. For instance, Poland and Czech Republic demonstrated 3% and 3.7% compounded annual growth in R&D investments intensity between 2010-2016 respectively vs. EU average of 0.8% (European Commission, 2018b). Among all CEE markets, Poland and Czech Republic are showing similar very positive growth in R&D investment intensity which in some cases is above some of the EU-15 economies, such as Spain or Portugal (European Commission, 2018b). However, the R&D intensity growth in Poland and Czech Republic has been often driven by EU funding and the concern remains whether these markets are able to sustain similar level of R&D investments if EU funding begins to reduce (European Commission, 2018b). Therefore, firms need to re-align their funding activities by broadening their sources of financing to ensure similar intensified R&D intensity is in place to support innovative activities. Furthermore, Radosevic (2017) notes that upgrading in management practices,

[6] https://www.imf.org/en/Countries/CZE
[7] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

focusing more attention on labour productivity enhancements, new skills development, upskilling supplier relationships and focus on production quality will be essential in supporting innovation agendas in these markets.

In summary, the significance and novelty of this research in the context of CEE economies is threefold. First, the process of catching up with more advanced Western markets will now require a different focus and approach. The Economist Intelligence Unit (2008) noted that majority of innovation in CEE region came from multinational, foreign owned enterprises which made local firms over-reliant on the absorption of innovation and foreign direct investments. Historically, CEE markets benefited from low labour costs which supported Polish and Czech exporters but also enabled an inflow of foreign direct investments that contributed to the creation of new production plants (Breznitz and Ornston, 2017). For instance, the labour productivity in Poland remains at half of its German equivalent and innovation could help in breaching this gap (World Bank, 2016). In addition, OECD recognises a low productivity of Polish micro segment (a segment which is also prominently represented in our study) as firms previously focused on adoption of technology, rather than R&D expenditures to support breakthrough innovations (Goujard and Guérin, 2018). Hence, EU together with public policy makers should aim at providing more credit towards R&D activities that support innovation, however ensuring that high-productive SMEs are foremost benefiting from the subsidies (Goujard and Guérin, 2018). The "productivity catch-up" in Poland will require sustained investments in knowledge-based capital, an intangible asset (e.g. software, data, workforce skills, firm's organisational structures, etc.) which has been significantly under-invested in Poland vs. other CEE markets (i.e. slightly above 1% of GDP for Poland, vs. c4% in Czech Republic; Goujard and Guérin, 2018). With micro segment (which is usually more severely affected by the access to financing) representing c35% and c32% in Poland and Czech Republic respectively, the relative investments in innovation (e.g. R&D spending) are smaller than in other OECD countries (Goujard and Guérin, 2018).

Second, access to financing and development of domestic capital markets equipped with various financing instruments (e.g. investment funds, venture capitalists, etc.) to complement traditional banking will be key to support capital-intensive innovations of CEE economies (Krajewski, 2014). In the Polish and Czech context, the key aspect of the economic transition related to the evolution of their banking sector. With Poland, categorised as "advanced reformer", the experiences in transition could serve as an example for less developed CEE economies, especially in the context of banking restructuring & development (Balcerowicz

and Bratkowski, 2001). Effective banking supervision, enforcement of high standards in corporate governance, bank privatisation aiming at creating conditions for long term investment and macro-economic stability have been named as key lessons learned in Poland which may be useful for other markets going through the transition process (Balcerowicz and Bratkowski, 2001). However, intensified privatisation process of the banking industry during the transition process had an impact on the public opinion, especially during the 2008 financial crisis (Bonin et al., 2014). The distinctive characteristic of CEE economies related to the share of foreign-ownership in banking sector (Bonin et al., 2014). For Czech Republic and Poland, the asset share of foreign banks in the overall banking sector amounted to 85% and 72% respectively in 2010 which considerably increased dependency on foreign funding but also played a significant role in importing economic distress associated with 2008 financial crises (Bonin et al., 2014). With liquidity crisis, most foreign owned entities re-assessed their policies towards international subsidiaries to reflect more conservative lending approach and to reduce risk exposures, which eventually led to lower availability of credit in markets that were heavily dependent on foreign-owned banks (De Haas, 2014). Especially in the context of our study, availability of SME funding in Poland and Czech Republic have already been a concern before financial crisis, however the resultant import of "financial shock" by multinational financial institutions to CEE markets resulted in an even more difficult access to financing in times where firms most needed it (De Haas, 2014). Hence, the ability of policy makers is to ensure financial systems balances between global international and local funding to ensure intermediation is not affected when external shocks impact foreign institutions and their ability to finance local entrepreneurs. Therefore, the significance of our study to promote diversification of SME finance instruments is even more relevant as it adds to the debate on banking intermediation in moments where markets are over-reliant on foreign-owned lending institutions (e.g. Polish and Czech markets).

In addition, the discussion on finance diversification allows to explore new concepts (e.g. *diversified funding base*) for economies of Poland and Czech Republic. The findings are significant as both markets are subject to a considerable SME financing gap and poses a relative limited ability to expand beyond traditional financing sources (Qi and Ongena, 2019). Financing and ability to broaden financing methods is still not comparable with Western Europe, however ability to expand beyond traditional bank lending could reduce the dependency on external credit market environments and allow for reduction in SME financing gap (Boschmans and Pissareva, 2018). However, as discussed above, a relative

high share of foreign owned banks operating in Poland and Czech Republic, may impact the availability of bank credit in a moment of adverse financial condition of foreign parent institutions in their home markets. Qi and Ongena (2019) noted a limited availability of external finance alternatives to bank lending and therefore SMEs in Poland and Czech Republic may be overly reliant on bank credit. In such conditions the link between innovation and availability of bank lending will intensify in the event of external financial distress or reduced availability of bank credit, negatively affecting SME innovation (Qi and Ongena, 2019). We recognise that SMEs in our sample are dependent on bank debt due to the nature of both economies, however we further expand on the observations of Qi and Ongena (2019) and provide insights into innovation dynamics once SMEs increase their share of external finance or diversify their funding base. The results (especially diminishing returns with over-diversification) set foundations for future studies on markets with similar dependency on traditional bank funding and serve as a reference base for studies on more developed markets where external non-bank finance is more accessible.

Third, CEE economies need to develop a more coherent approach to improve the quality of public institutions and encourage policies to stimulate R&D investments in highly innovative activities (Krajewski, 2014). In addition, CEE economies will need to invest more in high-value products and participate in global value chain via enhanced collaboration (McKinsey Global Institute, 2013). With high share of manufacturing, public policy makers should encourage investing in technical education, offer R&D tax incentives and financial aid to support more advanced technological innovations within the supply chain (McKinsey Global Institute, 2013). For instance, the CEE region has established a strong position in automotive manufacturing and assembly and the next step will be to enhance its productivity by transforming it into a knowledge-intensive and innovation-led manufacturing (McKinsey Global Institute, 2013). In this context, improvements in inter-firm collaboration will be essential to knowledge exchange and will support CEE region in moving up the supply value chain. For instance, *percentage of innovative Polish SMEs collaborating with others* stood at 3.5% in 2014, vs. an EU average of 11.22% (European Commission, 2017b). Same metric for Czech SMEs amounted to 10.03% which is still below the EU average (European Commission, 2017b). To improve these metrics, SMEs need to focus on activities that support their collaborative arrangements. For instance, the breadth of collaborative associations will be essential for SMEs in CEE region as it allows for more broader knowledge exchange and supports in creation of an *absorptive capacity* which helps a focal

firm in assimilation and usage of knowledge within the partnership (Cohen and Levinthal, 1990). On the other hand, in the historic setting of CEE region, suppliers have played a dominant role due to the scarcity of resources. Thus, intensity of associations with suppliers in CEE region will likely remain important in supporting innovative activities, however firms should ensure intensity of collaboration enhances knowledge-creation and improves industry capabilities.

Finally, a strong entrepreneurial private sector with managerial skillset, open to new technologies, knowledge and collaboration will be essential for CEE markets to succeed in building innovation-led economies. In the Polish context the "shock therapy" introduced with Prof. Balcerowicz economic reforms involved restoration of macro-economic balance, stabilisation of prices, reduction of goods shortages, liberalise prices and trade (Gomulka, 2016). Already in early years of transition, Prof. Sachs, who has personally advised the Polish government, recognised the positive effects of economic reforms (mainly liberalisation and privatisation activities) which demonstrated in a steady GDP growth since 1991 and a rapid creation of private sector which represented more than half of the economy just few years after the transition (Allen, 1994). These observations align with Gomulka (2016) who highlights the phenomenon of Polish transformation, setting its example apart from other CEE economies, which was underpinned by a rapid increase in the number of newly created privately-owned firms. This acceleration in private sector has continued even despite relative slow progress in privatisation of the large state-owned corporations (Gomulka, 2016).

Therefore, in the CEE context, a constant re-design of management strategies combined with building managerial aspirations and knowledge creation will be essential in taking advantage of innovation enablers available on the market (e.g. availability of funds, implementation of new ways of working, etc.). In the same spirit, firms, will be required to actively overcome innovation challenges faced in the CEE region (e.g. lack of diversity in funding options, etc.) to create environments that are conducive to innovations. Thus, the analysis of certain management attitudes in Poland and Czech Republic provides new insights into managerial influences on innovation from the angle of management strategies and management ambitions / aspirations. This is novel in Polish and Czech context as the innovation discussion frequently focuses on tangible external factors required to innovate (e.g. financing, resources, etc.), while some less-tangible managerial aspects may be overlooked (Goujard and Guérin, 2018). A further novelty in this section relates to the fact that certain

entrepreneurial behaviours (e.g. willingness to search for new innovations) is also discussed and our results expand some of earlier findings of Wziatek-Kubiak and Peczkowski (2010) of certain industries / firm clusters that may be more reluctant to innovate. As noted earlier, better understanding of management barriers and enablers to innovation and improvement in management skills, capabilities and practices will serve as a key element for further development of innovative capabilities of firms in CEE region (Radosevic, 2017). Thus, recommendations from our study contribute towards more empirical evidence for innovation-enhancing strategies at managerial and policy levels within the CEE region.

In summary, the research contributions discussed above are significant in the context of Poland and Czech Republic, but also in the wider context of CEE economies. Poland and Czech Republic although considered as OECD high income economies[8], experience number of factors that affect the conditions in which Polish and Czech SMEs innovate. Therefore, the significance of this research is that it analyses the influences and characteristics of these unique factors affecting innovation in both studied markets. Poland and Czech Republic are still on a transition path from being innovation importer (or adopter of technologies from more developed markets) to truly innovation creators (Qi and Ongena, 2019). While Polish and Czech economic environment has considerably changed over the three decades, the core elements of innovation influences (e.g. financing, co-operation, management strategies) may represent still an under-developed character as compared to more developed markets. Exploring these influences allows us to assess their importance, impact and conditions for policy makers debate to articulate areas where support for SMEs is most needed. Therefore, the study unleashes certain nuances in the context of financing, co-operation and management approaches that allow for new observations to be drawn for Poland and Czech Republic and markets that are in the similar stage of development.

## 1.6. Chapter summary

This introductory chapter has presented the core themes for this study, namely the entrepreneur's choices related to funding diversification and co-operative activities, together with assessment related to challenges and enablers to innovation. These three themes provide an opportunity for further exploration and aim of this study is to provide further insights into studies of influences on innovation. By introducing new areas (e.g. diversification of funding

[8] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

base) we hope to add to the literature additional dimension in which we assess innovation. Linking it with remaining elements of the study, collaboration and manager's perceptions of what hampers and supports innovation, we build a more connected research into influences of innovation. Our unique data from CEE economies give additional interesting angle to the research as these markets observed limited attention in academic study of above three themes.

The remaining sections of this thesis are set out as follows. In the next section we discuss background and methodological approach, such as data collection, and data characteristics. Following to that, each paper is presented in Sections 3, 4 and 5. Subsequently, Section 6 summarises research findings and contributions from managerial and policy perspectives. This is then expanded by discussion of future areas of research. Finally, Section 7 draws this thesis to a close and includes appendices on the survey design in Polish and Czech languages.

# 2. Background and Methodical Approach

## 2.1. Chapter Introduction

As described in earlier sections, the papers herein include all the required details regarding research methodologies relevant for each paper. Thus, the aim of the below section is to provide further details on items that for practical reasons (such as journal word count limitations) would not naturally fit in the academic research paper. Hence, below we will discuss further background on themes selected for the research, survey approach, SME characteristics and analytical methods deployed. The below sections start with providing some more background to the three themes selected for this research (i.e. diversification of funding sources, co-operation, challenges and enablers to innovation). The aim is not to repeat what is already described in the research papers but to complement and provide further details and expand on certain topics related to themes background and research methodology. For example, sample and survey approach (Section 2.4) and role of the third party (Section 2.5) in gathering the data is mentioned in the research papers where required, however below sections expand and provide further necessary details. Section 2.7 provides details on the characteristics of respondents (such as company age, employment structure, industry categorisation, etc.). Finally, while these sections add more details on the research methodology, the details on respective constructs and variable creation are included in relevant academic papers, rather than in this section for clarity and easier reference.

## 2.2. Innovation context

In this research innovation is understood as an activity to develop a new product or improve the existing product or process. We build on earlier research that used categorical measures to capture innovative output, for instance distinguishing between radical (i.e. new) or incremental (i.e. improvements) for product or process innovations (e.g. De Propris, 2002; Tomlinson and Fai, 2016). Similarly, our research is in line with Leiponen and Helfat (2010) who define process innovations as improvements in manufacturing flexibility or production costs, whereas product innovations target improvements in existing products or development of completely new product. Both process and product innovations may exist in different stadiums of company life cycle, however the methods in which a firm is applying the

innovation may vary across companies. Depending on the financial position, firms may invest in own R&Ds, acquire knowledge from external sources or collaborate with other firms in an increasingly globalised world to support the generation of new innovative capabilities (Hausman and Johnston, 2014). The effects of investments in R&D lead to quantifiable results in improved company's performance and may have a positive impact on the overall economy (Hausman and Johnston, 2014). Resilient economy requires firms to invest in radical and incremental innovations, however public policy should support the development and adoption of new technology and knowledge that will contribute towards a more balanced sustainable economy (Cooke and De Propris, 2011).

Furthermore, Gilbert (2006) notes that innovation is a general profit which is earned when a firm invests in R&D compared to the same firm not investing in R&D. While, this method of analysis simplifies the measurement of innovation and relies on the quantifiable accountability of R&D effects on ultimate production results, other studies point towards the increase in knowledge capital as intangible benefits of innovation (e.g. Romijn and Albaladejo, 2002). That is why Nauwelaers and Wintjes (2000) recommend increasing availability of funds for SMEs and suggest activities should be undertaken to strengthen funds absorption by enhancing learning and trainings that lead to the development of firm's human capital base. With greater absorption of funds, firm's innovation capability increases, however success often depends on manager's ability to transform innovation into commercial benefit (Skarzynski and Gibson, 2008).

To create a manageable research project, this thesis focuses on three specific themes of influences on innovation in the context of CEE economies. These themes are diversification of firm's funding base, firm's co-operating activities and manager's perceptions towards challenges and enablers to innovation. Below sections (2.2.1-2.2.3) provide a brief introduction to these themes which are then further explored in the academic research papers included in Sections 3-5.

### 2.2.1. Access to finance and case for diversification

Previous research provided evidence for difficulties among SMEs is accessing financing, mainly because of shorter credit history, information asymmetry between lending institution and entrepreneur, and significant inherent risks in business operations at the beginning of the firm's existence (Hyytinen and Toivanen, 2005; Deffains-Crapsky and Sudolska, 2014; Romero-Martinez et al. 2010). This has intensified following 2008/9 financial crisis, where

Boschmans and Pissareva (2018), in their OECD study, note the decline in available bank credit to SMEs as banks became more reluctant to lend and cost of credit increased due to higher capital requirements imposed on the banking sector. While the financial crisis resulted in worsening of the economy it has also impacted the profitability of SMEs, deteriorated their credit scoring impacting the availability of traditional sources of finance (e.g. bank loans, overdrafts, working capital, etc.) which further contributed to the vulnerability of the SME sector (Boschmans and Pissareva, 2018). Although, since the financial crises policy makers focused on sustaining bank finance and availability of credit to SMEs, their actions resulted in further strengthening of SME's over-reliance on bank's debt, ultimately increasing firm's dependence on bank debt during future adverse macroeconomic developments (Boschmans and Pissareva, 2018). Recognising this fact and in the attempt to reduce the reliance on bank's debt, OECD (2017) argues that policy makers should become increasingly aware of the importance of diversification of funding sources available to SMEs. Thus, the rationale for this thesis becomes even more important as we add to the discussion on effects of funding diversification and provide empirical evidence about its impact on innovation. We add to the current policy makers debate on SME finance and provide managerial and policy recommendations.

### 2.2.2. Co-operation

Post transformation, the firm's co-operative activities and their impact on innovation in Poland and Czech Republic have not been widely researched. Nevertheless, there were attempts to look at co-operation from the regional perspective. Kraetke (1999) identified significant opportunities for Polish and German firms to co-operate within the Polish-German border. To benefit from the neighbourhood both Polish and German policy makers need to promote innovation-driven co-operation and strategic forward-looking arrangements which not only rely on relative cost factor advantages but on enhanced institutional and production capabilities (Kraetke, 1999). However, the proximity of neighbourhood may become less relevant. With recent developments in technology and digitisation, SMEs can scale up faster, reach more markets and customers, even with fewer employees but leveraging technology advancements and innovation (OECD, 2018).

According to Small Business Act Factsheet (European Commission, 2017b), *percentage of innovative Polish SMEs collaborating with others* was at 3.5% in 2014, vs. an EU average of 11.22%. Czech SMEs performed slightly better with same metric at 10.03% (European

Commission, 2017b). As collaboration becomes increasingly more important within the conditions of progressively interconnected regional and European economies, the themes of supply chain collaboration have not attracted much attention in Polish and Czech context. Hence this research adds to the literature by systematically and simultaneously exploring concepts of *breadth* and *depth* of relationships within dyadic up and downstream supply chain relationships. As argued by Winiecki (2003) the SME sector in CEE economies is suffering from the lack of underlying data. This research with its unique set of data from Polish and Czech SMEs contributes to the study on innovation within CEE economies and provides with some policy and managerial recommendations, together with areas for future research.

### 2.2.3. Challenges and enablers

Understanding manager's awareness of barriers and enablers to innovation allows policy makers and firm's management to adopt strategies that enhance management abilities to take advantage of available knowledge to overcome obstacles and support innovation. Challenges are usually categorised as internal or external barriers to innovation (Hadjimanolis, 1999; Madrid-Guijarro, et al., 2009). Enablers may include areas where management is establishing mechanisms to support organisational culture which fosters innovative thinking (Ar and Baki, 2011; Kmiotek and Lewicka, 2008). In the Czech context, Vokoun (2016), noted three main barriers to innovation: 1) innovation costs, 2) lack of information (e.g. knowledge), and 3) lack of skilled human base. In addition, (Ehrenberger et al. 2015) also adds intensified competition and lack of co-operation with academic research institutions that may constitute a barrier for Czech firms to innovate. In the Polish context, Brandt (2018), in the OECD study, recognises three main challenges such as: 1) relatively limited investments in R&D, 2) weak commercialisation of innovations and 3) limited innovation supporting activities within firms.

While structural challenges (e.g. access to finance, skilled personnel, R&D spending in percentage to GDP) are broadly similar across Poland and Czech Republic (European Commission, 2016), it is worth exploring differences in which Polish and Czech managers recognise these challenges and approach they use to either support or enhance innovation. This thesis adds new insights as it expands on the spectrum of challenges and enablers by exploring management attitudes previously under-researched such as: "*we don't need more innovation*" or strategic decisions to continuously re-organise firm's operational activities

(e.g. in forms of working groups or collaborative activities). We recognise that list of challenges and enablers may not be exhaustive, however we broaden the view in which we look at the obstacles and enablers by linking them with the discussion in management literature. Based on the empirical results we derive managerial recommendations included in the paper.

## 2.3. Research approach

As the objective of this research is to understand the influences of innovation within SMEs in Poland and Czech Republic, a large-scale survey has been designed to gather insights and behaviours within the analysed SMEs. Below sections provide for more detailed discussion on the methodological approach.

## 2.4. Sample and survey approach

In this research a third-party firm (ABMmedia[9]) was employed to generate a sample of SME firms from Polish and Czech Republic SME registers. ABMmedia is a Polish based company offering access to more than 1.5m of Polish SMEs in different industries and has access to unique data sets of European SMEs, incl. Czech Republic. As the access to the Polish and Czech SMEs represents a challenge due to data confidentiality, the usage of the ABMmedia represents a very useful support in accessing Polish and Czech SMEs for academic and research purposes. ABMmedia is an experienced provider of survey-based research to many Polish universities. The translation of the survey into the Czech language has been conducted by ABMmedia, while the translation into Polish language has been performed by the author. Both surveys have been included in the Appendix to this thesis.

The following steps have been taken to create the sampling frame:

1) To select the sampling frame, we drew representative random samples from four main industries (manufacturing, trade, services, construction) used by Central Statistical Office of Poland as reference.
2) The representativeness of the sampling frame was compared to the distribution of SME population used by Central Statistical Office of Poland and analysis revealed

[9] http://www.abmmedia.com.pl/index.php

no significant differences between sampling frame and the target population. In 2015, a sampling frame of 2907 Polish and Czech SMEs was created.

3) To provide additional insights on SMEs operating activities, the 2907 SMEs were sent email surveys in line with recommendations for online surveys (Furrer and Sudharshan, 2001; Evans and Mathur, 2005). The questionnaire asked detailed questions on industry sub-categorisation following earlier research (e.g. Klonowski, 2012) and details are included in Appendix A of each of the three papers in this thesis.
4) In total, 321 valid responses received (11% response rate); this represented a sampling error of 5.2% at the 95% confidence interval, which is within acceptable limits for survey research (Oerlemans *et al.*, 2006).

## 2.5. Third party's role and responsibility

This research follows the recommendations of Michaelidou and Dibb (2006) in designing online surveys who recommend selection of appropriate forms for online usage (e.g. URL embedded design). Third party provider – ABMmedia has been appointed to conduct the online survey to the Polish and Czech SMEs and roles and responsibilities have been clearly defined before the survey was launched. In line with the literature (e.g. Fuller and Sudharshan, 2001; Evans and Mathur, 2005), the ABMmedia received following instructions to perform the survey process:

1. Determine the sample frame which has the characteristics of the population of Polish and Czech SMEs
2. Select the sampling frame elements in a random stratified manner to represent the target population of SMEs in Poland and Czech Republic. Firms were selected based on the SME definition of European Commission (2015)
3. Design online survey formats in Polish and Czech language versions
4. Send the link to the online survey by e-mail to the selected companies from the sampling frame
5. Send the survey emails in tranches, rather than using blanket emailing as per recommendations of Evans and Mathur (2005). Evans and Mathur (2005) recommend that the best use of online surveys is achieved when a market research company uses sample of individual email addresses from their database to perform

the survey instead of using blanket emails which may lead to skewed results as email filters may consider blanket emailing as spam.

6. Repeat the online survey. The online survey emails have been repeated three times and Evans and Mathur (2005) recommend repeating online surveys as the costs of any additional survey are low as the technical functionality has already been established

Over the course of the research, the author has remained in close contact with the ABMmedia to ensure all the procedures are executed in a desired way and took following steps in survey administration:

1. The survey introduction email has been constructed by the author to explain and contextualise the research question. A proper definition of the ask and research question helps to increase the response rate.
2. The outline and purpose of the survey has been clearly explained in a simple language to ensure respondents understand the reason of the survey straight from the moment they open the email.
3. The anonymity of responses has been assured in the introductory email to encourage participation and re-assure participants on ethical usage of the data gathered
4. The survey has been given a short title (in line with the thesis title) and explained the importance of SME innovation to Poland and Czech Republic in a simple manner.
5. The survey email has been signed with the name of the author to increase credibility of the email
6. The author has ensured there is no intervention from the author nor the ABMmedia in how the companies are completing the survey. Evans and Mathur (2005) inform that self-administered online surveys are preferable and eliminate the interviewer bias
7. Post each survey email, the author received a summary excel with response results and one aggregated database following all responses have been received.
8. Data cleansing techniques have been adopted in this research following recommendations of Doganaksoy and Hahn (2012). Following checks have been performed on the dataset, e.g. checking the credibility of the data (e.g. “do data look reasonable”, do numbers add to 100%, are any critical data missing, etc.). In this process, 7 responses in Czech sample have been removed due to data incompleteness.

## 2.6. Questionnaire and variable construction

The survey questions have been based on the literature and previous academic studies. The information on respective question's source is specified in the survey in the Appendix 1: Survey (English Translation). The questionnaire also includes new specific questions which are relevant for the analysed research topic. Most of the questions are based on the 7-point Likert scale to ensure granular observations. The survey is structured into four main categories: 1) Company data; 2) Firm's research and development activities (which includes sections on challenges and enablers to innovation); 3) Firm's source of financing; 4) Firm's co-operative activities. The primary variables used in the survey for construct creation have been defined in appendix of each academic research papers included herein.

## 2.7. Respondent's characteristics

While each paper provides for detailed summary of variables used it was not practical to include extensive information on participant characteristics. The aim of below section is to expand on what is included in each of the academic papers and provide details on key characteristics of respondents. Starting with firm age, the surveyed firms represent relatively balanced aging structure as it is presented in the below table.

**Table 1. Firm age**

| Year in which company was established | n | % |
|---|---|---|
| before1990 | 57 | 17.81% |
| 1990-1995 | 104 | 32.50% |
| 1995-2005 | 98 | 30.63% |
| after 2005 | 61 | 19.06% |
| *No response* | 1 | 0.31% |
| **Total** | **321** | **100%** |

In terms of corporate and ownership structure, 88 firms (27.41%) are categorised as family owned businesses, 78 firms (24.30%) as sole traders, 20 (6.23%) as partnerships, 11 firms (3.43%) as subsidiaries of foreign-owned companies and 2 firms (0.62%) as franchise corporations. There has been a large proportion of firms (122; 38.01%) that answered "other" in the ownership structure. This large figure may suggest that ownership categories used by Ortega-Argilés *et al.* (2005) and Laforet (2013) may not necessarily fit to the characteristics of Polish and Czech SME sector. In addition, the data represent a strong (c46%)

representation of firms from a micro segment (e.g. less than 10 employees).

**Table 2. Employment structure**

| Employment structure | N | % |
|---|---|---|
| Less than10 employees | 150 | 46.73% |
| 10-49 employees | 100 | 31.15% |
| 50-99 employees | 42 | 13.08% |
| 100-149 employees | 14 | 4.36% |
| 150-199 employees | 6 | 1.87% |
| 200-250 employees | 3 | 0.93% |
| More than 250 employees | 6 | 1.87% |
| **Total** | **321** | **100%** |

Furthermore, the survey outcome showed evidence that the industry categorisation following Klonowski (2012) has not provided for a full explanation of industry types among Polish and Czech SMEs. The high degree of "others" in the responses may represent the granular and fragmented character of Polish and Czech SMEs that may not easily fit to the broad categories suggested by Klonowski (2012). Further studies should include a more specific and detailed categorisation of industry segments with potential explanation of activities which are usually performed within the segment to ensure a more richer data set.

**Table 3. Industry categorisation**

| Industry | n | % |
|---|---|---|
| Production | 92 | 28.66% |
| Construction | 33 | 10.28% |
| Retail and Wholesale | 34 | 10.59% |
| Hotels and restaurants | 1 | 0.31% |
| Transport | 2 | 0.62% |
| Telecommunications | 8 | 2.49% |
| Financial Services | 23 | 7.17% |
| Health | 2 | 0.62% |
| Other | 126 | 39.25% |
| **Total** | **321** | **100%** |

Regarding company activity most SMEs responded to be either among Subcontractors or Niche Players. However other two categories, Service Provider and Innovator, are well represented in the survey responses. Potential new studies should detail the four categories listed below and potentially capture the extent (e.g. "how often" questions) as to which firms engage in these activities to provide for more insights into firm's operations and strategy.

**Table 4. Company activity**[10]

| **How would you describe the activities of your company?** | **n** | **%** *(firms could select multiple answers)* |
|---|---|---|
| Service provider for larger enterprises (e.g. shared service centre) | 95 | 33.69% |
| Subcontractor (supplier of products to bigger enterprises) | 122 | 43.26% |
| Niche player (providing products which are economically not attractive to bigger companies) | 116 | 41.13% |
| Innovator (market leader in products which require high human capital investment) | 56 | 19.86% |

Lastly, an interesting observation can be derived from the R&D spending analysis. Most of SMEs seem to spend between 1-5% on their R&D in average in the last five years. The survey outcome provided an evidence for a significant commitment among Polish and Czech SMEs to contribute towards R&D activities. For instance, ca. 15% of Polish and Czech SMEs responded that they spent *between 21-30%* and *greater than 30%* of firm's turnover on R&D activities.

**Table 5. Proportion of firm's turnover spend on R&D**

| **Approximately, what proportion of your firm's turnover (either direct budget or staff time) was spent on Research and Development activities in the last 5 years** | **n** | **%** |
|---|---|---|
| 0% | 40 | 12.46% |
| 1-5% | 128 | 39.88% |
| 6-10% | 64 | 19.94% |
| 11-20% | 39 | 12.15% |

[10] numbers don't sum up to 100% or 321 population size as firms could select multiple answers

| | | |
|---|---|---|
| 21-30% | 24 | 7.48% |
| Greater than 30% | 24 | 7.48% |
| *No response* | 2 | 0.62% |
| **Total** | **321** | **100%** |

## 2.8. Chapter summary

This chapter has discussed the background and methodological approach for each of the papers herein. The chapter explored the context in which Polish and Czech SMEs operate by providing further insights into the three main themes analysed in this research (i.e. diversification of funding base, co-operation activities along supply chain, challenges and enablers to innovation). This section has also provided a wider insight into the methodological approach used in conducting the survey, such as survey approach, role of the third party in data gathering process and details on how questionnaire has been constructed. A far more comprehensive discussion of analytical methods used for each of the analysed three themes can be found in the papers, together with relevant comments related to respective variable construction and statistical methods used.

In the next three sections, each of the papers is presented, beginning with declarations of authorship. Following the papers, the Section 6 aggregates overall thesis results and discusses the thesis contribution, linking the findings into a consistent summary. Final Section 7 brings the thesis into conclusion and provides some final remarks.

# 3. Paper One: Diversification

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<tr><td colspan="10">This declaration concerns the article entitled:</td></tr>
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<tr><td>Permission</td><td colspan="9">At the time of this PhD submission, the paper is in a draft form ahead of the submission to one of the ABS-4 grade journals. At this stage no permission is required from any journals.</td></tr>
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<tr><td>Signed</td><td colspan="4">Kazimierz M Kelles-Krauz</td><td>Date</td><td colspan="4">30/11/2018</td></tr>
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# Diversification of Funding Base and its Impact on SME Innovation. Evidence from Poland and Czech Republic

**Abstract**

Firms increasingly search for new ways to increase their innovative capabilities. The existing literature has emphasised the relevance of access to capital. However, less attention has been paid to the effects of the diversification of a firm's funding base. We explore this concept by examining the entrepreneur's choices to diversify the capital base using a unique survey of 321 Polish and Czech Small and Medium Enterprises. Utilising the data, we construct multi-scalar and multi-dimensional measures of funding diversification and its impact on innovation. Using multivariate analysis, we examine the relationship between SME-firms' funding base diversification and innovation. Our results indicate a positive linear relationship between funding base diversification and process / product innovation independently, an inverted-U shaped relationship for product innovation, and a positive linear relationship for total (process plus product) innovation. Our results point towards a complex relationship between a firm's capital structure and corporate strategy, suggesting funding diversification may be viewed as an additional dimension to influence firm's innovative capabilities.

## 3.1. Introduction

Over the last five years an extensive policy debate has emerged on the importance of SME finance diversification to address barriers in accessing SME funding (EBRD, 2014; OECD, 2015a; OECD 2015b; EC, 2015). With the SME sector employing almost 90 million people and equating to c.67% of total EU employment, bank lending remains the most relevant source of external finance (EC, 2015). To reduce the reliance on a single source of finance, policy makers have begun to encourage SMEs to broaden their funding base to enable further growth and support innovation (European Parliament, 2016; OECD, 2015b).

Access to SME finance has figured prominently in the literature and is particularly important in the context of innovation. Numerous studies (e.g. Mulhern, 1995, Hyytinen and Toivanen, 2005; Klonowski, 2012b; Wonglimpiyarat, 2015) have shown that SMEs face challenges in

attracting finance to enable further growth. In addition, some research postulated that limited access to SME finance hinders firm's innovative capabilities (Hyytinen and Toivanen, 2005; OECD, 2015b; Madrid-Guijarro, *et al.* 2016). This may stem from the fact that most of the SMEs access external capital mainly through bank loans, venture capitalists or government financing (Klonowski, 2012b). However, banks are reluctant to accept risk from new SME ventures (Berger and Udell, 2006; Klonowski, 2012b) and venture capitalists are very selective in their search for new investees (Klonowski, 2012b).

These challenges are further enhanced with the diversity of the SME sector where 93% of all SMEs are micro firms (employing less than 10 people) and operating in the broad variety of sectors (EC, 2015). Given the variety within the SME segment, growing number of innovative start-ups and technology companies, access to some of the SME sophisticated finance instruments remains limited (OECD, 2015b). While policy makers recognise SMEs' need to adopt differentiated financing strategies, 77% of all SME finance in Europe is still provided by banks (European Parliament, 2016). To limit this reliance, policy makers underline the need for improved public and private funding opportunities to provide more tailored and diversified financing means for SMEs (European Parliament, 2016). Although suggested by policy makers (e.g. EBRD, 2014; OECD, 2015a; OECD 2015b; EC, 2015) the impact of diversification in the funding base on firm's innovation has not attracted much research attention to date; therefore, this research aims to close this gap. We explore the relationship between SME-firms' funding base diversification and (process and product) innovation, focussing on SMEs in Poland and Czech Republic.

While controlling for a broad set of firm-specific characteristics, this research aims to explore the impact of funding diversification on SME's innovative performance. The study is based on an original survey of Polish and Czech SMEs and is novel in its approach as it focusses on a broad set of factors that determine funding diversification, rather than the number of lending institutions as previously studied in the literature (e.g. Berger and Udell, 1995; Ferri and Messori, 2000; Mercieca, *et al.* 2009; Hernández-Cánovas and Koëter-Kant, 2010).

The research is relevant within the context of Central and Eastern European (CEE) economies. Although World Bank considers both Poland and Czech Republic as OECD high-income economies[11] and both markets have achieved significant progress in their

[11] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

economic development over the past three decades, the process of catching up with more developed economies is continuing. Access to finance and availability of external (non-bank related) financing in CEE region continuous to be at lower levels as compared with more developed markets. By assessing the effects of funding diversification on innovation, we add to the literature on SME financing gap and significant link between debt finance and innovation. Furthermore, while the introduction of a '*diversified funding base*' concept adds to the debate on innovation studies in CEE economies, it also facilitates a novel opportunity to assess whether over-diversification can exist and what impact it may have on SME innovation. Thus, it provides empirical evidence in the policy debate and sets the foundation for future studies on the *optimal funding diversification* level to support SME innovation.

This paper is organised as follows. The first section covers the theoretical foundations, exploring the links between finance and innovation, and provides an overview of the relevant literature on SME finance and innovation. The second section discusses the research methodology, and is followed by a third section focussing on analysis of the results. In the fourth section, we discuss the findings from both a managerial and a policy perspective. The final section concludes with areas for further research.

## 3.2. Conceptual Issues

### 3.2.1. Barriers faced by SMEs in accessing Finance

SMEs access capital either internally, due to their profit generating activities, or externally, with bank financing, venture capitalists and governmental financing being the main sources (e.g. Klonowski, 2012b). Funding instruments for SMEs predominantly include basic financial products such as overdrafts, short term lending facilities, working capital or stockholder's equity (e.g. Klonowski, 2012b). However, numerous studies (e.g. Hyytinen and Toivanen, 2005; Beck and Demirguc-Kunt, 2006; Romero-Martinez et al. 2010) have shown that SMEs are constrained in access to finance instruments which limits the firm's growth. In this section, we consider the literature relating to the barriers faced by SMEs in accessing finance, the implications for innovation, and the evidence from the emerging markets of Poland and Czech Republic.

Existing literature is consistent, noting that SMEs have relative difficulties in accessing funding, mainly due to shorter credit history, information asymmetry between lending institution and entrepreneur, and significant inherent risks in business operations at the beginning of the firm's existence (Hyytinen and Toivanen, 2005; Deffains-Crapsky and Sudolska, 2014; Romero-Martinez *et al.* 2010). In addition, Klapper *et al.* (2002) showed that SMEs have difficult accessing long term debt, and mainly use short maturity funding to finance their activities, thus, limiting SME's large scale and capital-intensive investments. Additionally, Hyytinen and Toivanen (2005) argue that capital markets available to SMEs are rather local, and the ability to tap into international markets may pose a challenge to many SMEs.

Furthermore, as most of the entrepreneurs who start their business activities are unknown to banks, funding opportunities are usually constrained (Hashi and Krasniqi, 2011). Many SMEs base their success on knowledge and expertise of their staff, therefore mostly on intangible assets which are not usually an accepted collateral for bank's lending (Deffains-Crapsky and Sudolska, 2014). The uncertain character of the venture, collateralisation level and usually initial status of firm's investments contribute to additional concerns among lending institutions (Deffains-Crapsky and Sudolska, 2014) and lead to often higher transaction costs to compensate for embedded risks (Mulhern, 1995; Mytelka and Farinelli, 2000; Hall 2002).

### 3.2.2. SME financing constraints and implications on Innovation

Numerous studies recognise the constrained access to finance as a key factor affecting innovation (e.g. Hyytinen and Toivanen, 2005; Beck and Demirguc-Kunt, 2006; Lewandowska, 2009; Klonowski 2012b; Szczepanska-Woszczyna, 2014; Lee *et al.* 2015). Due to inherent risks associated with the innovation investment and difficulties in accessing funds, SMEs feel constrained in the innovation process (Mytelka and Farinelli, 2000; Czarnitzki and Hottenrott, 2011). The risk averse attitude of lending institutions tends to favour less innovative, more routine based R&D investments with potentially less long-term impact on the economy rather than cutting-edge investments that often pose execution risks (Czarnitzki and Hottenrott, 2011).

In addition, the literature provides evidence of differences in accessing capital depending on firm's level of innovation capabilities. Lee *et al.* (2015), in their study of UK SMEs, demonstrated the difficulties in accessing funding for innovative SMEs as compared with

non-innovative SMEs. The root cause is related to the 2007-2008 financial crisis, which caused banks to reduce lending to innovative firms as compared with non-innovative firms where perceptions of lending risk was lower (Lee *et al.* 2015). Bergemann and Hege (2005) note different perceptions and uncertainties between time and capital required for innovative endeavours as another significant factor affecting ability of credit for SMEs. In addition, the criteria to continue financing for an innovative project are frequently different between investors focusing on return on capital and enterprise owners dedicated to the innovative project despite it bringing uncertain returns (Bergemann and Hege, 2005).

Furthermore, Wonglimpiyarat (2015) argues the SMEs life cycle span tends to be shorter than larger organizations, therefore their positive credit history is usually limited and requires additional collateral for banks and other investors. While financing constraints to support innovation within SMEs also apply to firms with longer credit history, a study by Madrid-Guijarro, *et al.* (2016) suggests that SMEs may moderate the financing constraints by establishing long-term relationship with their lending institutions. In addition, Hoegl *et al.* (2008) explored that in some instances financial constraints may act as enablers for firm's innovation activities. This, however, depends on certain conditions, such as team abilities to co-operate, creativity approach or project objective (Hoegl *et al.* 2008).

### 3.2.3. SME Innovation in Poland and Czech Republic

With regards to the emerging markets of the CEE region, the literature provides evidence that Polish SMEs facing challenges in accessing finance (Klonowski, 2012b; Walicka 2014). This arises mainly from ineffective governmental programmes not aligned to the needs of Polish SMEs (Klonowski, 2012b), bureaucracy in governmental financing (Walicka, 2014), insufficient financing from the private sector (Odrobina, 2016) and a high reliance upon foreign companies to fund innovation (Odrobina, 2016). In addition, the OECD[12] provides evidence for differences in the level of expenditure on R&D activities relative to the Gross Domestic Product (GDP). According to Odrobina (2016), this is one of the measures used to analyse the level of diversification of the funding base supporting firm's innovative activity.

It is important to note that both Czech Republic and Poland have greater reliance upon governmental funding to finance innovation as compared to more developed OECD

[12] OECD estimates based on OECD Main Science and Technology Indicators Database, February 2017, available at: http://www.oecd.org/sti/inno/rd_intensities.xls

countries which predominantly finance innovation from the private sector (Odrobina, 2016). For instance, OECD[13] notes that the Gross Domestic Expenditure on R&D for Czech Republic increased from 1.34% of GDP in 2010 to 1.95% in 2015[14] reaching the EU28 level. In the same period for Poland this estimate moved from 0.72% to 1.00% representing half of the EU28 level[15]. This highlights the relatively low reliance on private sector to support innovation, and aligns with the evidence provided by McLarty *et al.* (2012) in which Czech SMEs showed little usage of own funding to develop innovations. This demonstrated multiple challenges (e.g. product innovation, strategic setting and little know-how on knowledge transfer from more developed markets) and results in hindering the SME competitiveness (McLarty *et al.* 2012).

In addition, Odrobina (2016) notes that in the global leading economies the business supports 75% of the R&D expenditures, and the low involvement of the private sector to fund innovation in Poland and Czech Republic is one of the barriers to developing innovative capabilities in this region. Similarly, Szczepanska-Woszczyna (2014) argues that lack of policies to support innovative projects prevents smaller firms from being truly innovative and demonstrates that small firms predominantly use capital expenditures to fund operational stability rather than investments in new technologies. This leads to relatively low level of innovative activity placing both markets into a *Moderate Innovator* category based on 25 different indicators used in European Innovation Scorecard 2016 developed by the European Commission (EC, 2016a). To address these challenges, the European Commission is working on multiple policy and funding solutions to enable SMEs to access a broader range of financial instruments to support innovation (EC Memo, 2016b)[16]. To complement existing instruments, the European Commission is enabling access to EUR 315bn Investment Plan recognising the low level of private sector involvement in funding innovation and addressing the relative underdeveloped position of venture capital investments in Europe's SME sector (EC Memo, 2016b)[17]. In addition, several European organisations, including the European Investment Bank (EIB) and European Investment Fund (EIF) have launched several initiatives to provide liquidity to SMEs via different financial institutions and financial vehicles (e.g. securitisation platforms, "JEREMIE"-lending programmes[18]) to support

[13] Ibidem
[14] Ibidem
[15] Ibidem
[16] http://europa.eu/rapid/press-release_MEMO-16-2487_en.htm
[17] Ibidem
[18] http://www.eif.org/what_we_do/resources/jeremie/

innovation and demonstrating a significant commitment from the EU to address the liquidity gap for the SMEs (Romero-Martinez *et al*. 2010).

### 3.2.4. Entrepreneur's choice between SME finance instruments

We have thus far considered the literature that analyses the effect of financing constraints from the supply-side. In this section, we consider the entrepreneur's choice of financing (the demand side), and the effects on innovation.

#### 3.2.4.1. Bank finance and SME innovation

While the availability of funding sources increases, the EC (2015) recognises that SMEs are predominantly reliant on bank lending and the depth of relationship may influence innovation. Numerous studies on single or multi-banking relationships of SMEs (e.g. Berger and Udell, 1995; Ferri and Messori, 2000; Mercieca, et al. 2009; Hernández-Cánovas and Koëter-Kant, 2010) provide reasons why firms may engage with single or multiple borrowing relationships. Some of the empirical results suggests SMEs tend to have a single banking relationship if they belong to similar socio-economic setting which reduces information asymmetry (Mercieca, et al. 2009) or establish medium to long term relationships to reduce borrowing costs (Berger and Udell, 1995; Ferri and Messori, 2000). However, some factors, for instance, inefficiency of legal systems may encourage firms to engage in multiple borrowing relationships (Hernández-Cánovas and Koëter-Kant, 2010).

In addition, Kerr and Nanda (2014) recognise the growing literature suggesting a positive role of bank financing on innovation. Robb and Robinson (2014) highlight the importance of bank finance noting that majority of start-ups equally rely on owner's equity and bank debt to promote growth and innovation. EBRD (2014) argues that firms with access to bank credit are in average 40% more likely to engage in innovation than firms without access to bank financing. However, the rapid development of non-banking financial instruments has enabled the access to capital for SMEs via channels different from traditional bank lending (OECD, 2015a, 2015b).

#### 3.2.4.2. Venture Capital and SME innovation

Elitzur and Gavious, (2003) and Langeland (2007) identify venture capital (VC) and angels as significant financing sources for entrepreneurs. Fairchild (2011) develops a behavioural game-theoretic model analysing an entrepreneur's choice between VC and angel-financing.

In his model, the entrepreneur faces the following trade-off in making his financing choice: the VC may possess higher economic value-adding ability, but the angel may have softer skills, such as empathy. Entrepreneur's choice of financier depends on which factor dominates. Langeland (2007) argues that the venture capitalists act as significant intermediaries in the knowledge transfer between investors and entrepreneurs and the benefits are visible in knowledge intensive industries. Cable and Shane (1997) demonstrate that cooperation between venture capitalists and entrepreneurs has positive long-term benefits for both parties. Increased communication from entrepreneur and more frequent interactions from the side of VC improve the relationships and build a stronger base for the underlying company performance (Cable and Shane, 1997). Thus, effective cooperation is needed in the success of the VC-backed start-ups. In contrast, Stuck and Weingarten (2005) provide an insight into the negative implications of VC funding on innovation. Struck and Weingarten (2005) showed that due to their relatively short investment horizons, VC investors tend to fund start-ups with rather short break-even periods: hence VC investors may show a low desire for long-term investments in new innovations that bring returns at a later stage.

The target selection process within the venture capital fund is very robust and diligent. Venture capitalists tend to choose firms where innovation has already been present before their involvement and firms with higher than average expected returns (Caselli *et al.*, 2009). Hence, the involvement of venture capitalists may create a selection bias where only most innovative firms are selected for VC funding. These findings are in line with Engel and Keilbach's (2007) research on young German firms. Engel and Keilbach (2007) showed that venture-funded firms tend to report higher growth rates than firms without VC involvement, but their level of innovative capability remains not significantly higher as it was before the VC investment. In addition, Caselli *et al.* (2009) and Engel and Keilbach (2007) argue that the focus of venture capitalists remains on commercialisation of existing innovations with attention to improvements in operational capability and management that prepares for successful 'cash out' or 'exit stage'. Elitzur and Gavious (2003) argue that moral hazard issues may exist between entrepreneurs, angels and VC investors, in which various parties exercise different level of effort and opportunism regarding business choices. These inherent conflicts of interests between the financing parties may have an impact on firm's performance and innovation levels (Elitzur and Gavious, 2003).

### 3.2.4.3. Importance of SME governmental financing

Berger and Udell (2006) demonstrate the importance of the proper lending infrastructure (including local accounting standards) in increasing the financing sources available to SMEs. A better developed lending infrastructure enables easier access to capital and minimizes the limitations in accessing the funds (Berger and Udell, 2006). Madrid-Guijarro *et al.* (2016) suggests that in situations where resources are constrained, government policies to incentivise investments in innovation are even more important, given the significance of the SME sector to the whole economy. While governmental financing and EU policies provide important stimulus for the SME sector growth (Czegledi *et al.* 2015), the inefficiencies in the way it is granted may prevent effectiveness of this method, or crowd out private / VC investments (Massa and Testa, 2008; Wonglimpiyarat, 2015).

However, in situations where capital market imperfections exist, Hyytinen and Toivanen (2005) showed that governmental funding may provide disproportionate support to firms that rely more heavily on external financing. Such SMEs invest more in R&D if governmental financing is available to them (Hyytinen and Toivanen, 2005). However, Hausman and Johnston (2014) argue there is an insufficient level of governmental funding available to support innovation in the post-2007/8 financial crisis environment. This leads to a situation where greater weight is placed on banks, financial markets and private sector to finance innovation (Hausman and Johnston, 2014). This sector though may be reluctant to play an active role, given that credit crunch and lending restrictions have also resulted in less capital available for innovation support (Hausman and Johnston, 2014).

## 3.2.5. Funding diversification and innovation

As discussed earlier, on the supply side, financial constraints faced by SMEs relate mainly to the availability of funding instruments, information asymmetry or funding costs. In relation to capital diversification the demand side literature examines entrepreneurial choice between funding sources, such as VCs, angels and banks. Briozzo and Vigier, (2012) argue that the entrepreneur's decision to diversify the funding base is influenced by the search for an optimal capital structure. Much of the existing research on capital structure decisions focused on firm's different financial needs dependent on the stage in their organisational live (Berger and Udell, 1998; Gregory *et al.* 2005; Briozzo and Vigier, 2012). For instance,

Briozzo and Vigier (2012) note that firm's capital structure is influenced by either trade-off or pecking order theory.

First, the trade-off theory suggests that lending institution ability to lend for long term requires higher monitoring costs to compensate for the information asymmetry (Briozzo and Vigier, 2012). Elitzur and Gavious (2003) note that trade-offs and moral hazard relationships exist between various finance providers and entrepreneurs. Baniak and Dubina (2012) provide an extensive overview of the increasing game theoretic literature in innovation, suggesting that the analysis of trade-offs faced by finance providers in innovation is attracting growing interest from scholars. For example, Dubina (2010) investigates a game theoretic model, in the intra-organisational context, between a principal (owner) and an agent (investor) which highlights the importance of effective profit sharing essential to sustain innovative output. Hall (2002) notes that moral hazard exists in R&D investing firms primarily due to the fact of separation in company's ownership and management. The principal agent problem with managers being more risk averse than shareholders it is likely that managers will focus on less risky ventures thus hindering the innovative capabilities of a firm (Hall, 2002).

Second, the pecking-order theory introduced by Myers (1984) provides insights into the incentives for different decisions behind the firm's capital structure, suggesting firms will use internal funds first before reverting to external sources of capital. This is consistent with findings of Bravo-Biosca (2014) and Zoppa and McMahon (2002) who found supporting evidence that firms follow pecking order theory utilising retained earnings first, followed by short-term and long-term debt. Briozzo and Vigier (2012) argue that diversification of funding sources may be resultant from the SME's unique characteristics such as, age, education or objectives of the firm. However, Gregory (*et al.* 2005) found evidence that differences exist between size of firms and the level of stages of company development suggesting that there are other factors (e.g. SME owner characteristics) that may affect firm's decisions on capital structure.

In this research, we investigate whether a firm's incentive to innovate is affected by, and related to, funding-source diversification. There is a growing research interest in the debate on entrepreneur's decisions to broaden capital structure to support innovation (e.g. Smith, 2013; OECD, 2015b; Dutta and Folta, 2016). In the context of capital structure, the literature generally associates innovation with lower leverage (e.g. Hall, 1992; Balakrishnan and Fox,

1993; O'Brien, 2003). For instance, O'Brien (2003) argues this may be due to the character of business venture or corporate strategy as higher leveraged firms are frequently focused on large-scale or low-cost productions making it more challenging to become innovative. Additionally, Balakrishnan and Fox (1993) found that firms that are heavily investing in R&D will produce intangible assets or firm specific knowhow that is less likely to be accepted as collateral by the banks. However, Smith (2013), in the study of small nascent high-tech firms, found evidence that a capital structure with a higher degree of financial leverage may support innovation as additional debt relaxes the capital constraints faced by an entrepreneur in early stages of new venture financing. Furthermore, Smith (2013) suggests that firm's innovative capability is influenced by the source of external finance and access to differentiated sources of financing may contribute to greater innovative capabilities of young, privately owned firms. This aligns with Bartoloni (2013) who found that the need for external finance increases with innovative efforts suggesting that firms focusing on larger innovative projects may revert to external source of finance when internal resources are consumed.

So why does the diversification of funding base matter? First, OECD (2015b) points in the direction of addressing different capital needs dependent on different stages in firm's life cycle (OECD, 2015a). For instance, the ability to tap into a broader source of finance sources helps SMEs to limit the systemic risk resultant from financial markets adverse movements (OECD, 2015a). Second, recognising varying financial requirements, dependent on a firm's development stage, helps to address factors like cost of funds or governmental support, as firms broaden their funding base to attract financiers relevant to current needs (Bravo-Biosca, 2014). Finally, World Bank research notes that a firm's level of innovation capabilities could be enhanced by a better understanding of the optimal mix between various innovation supporting funding instruments (Bravo-Biosca *et. al*, 2012).

Considering the above discussion, this research brings forward the following hypothesis:

***H1:*** **Firms with a wider access to a diverse funding base are more innovative**

In summary, we expect that firm's product and process innovation to be positively associated with the degree of funding diversification. However, we expect that at certain point these relationships may demonstrate diminishing or negative returns on innovation. This may be for several reasons.

First, Dong et al. (2013) suggest that an excessive allocation of resources may lead to difficulties in co-ordination between resource providers and in effect reduce firm's innovative performance. In their research on human capital and IT resource allocation on innovation, Dong et al. (2013) found a curvilinear relationship resulted from excessive resource investments and suggest a diminishing returns relationship on innovation once complexity of co-ordination among resource providers is high. This may also relate to findings from Kochhar and Hitt (1998) in which the increase in the number of capital suppliers may lead to a situation where funding providers lose their ability to ''control and monitor the activities of the borrowing firm''. We believe this may be the case in our research as diverse needs and financial payback expectations of finance providers may have varying impact on firm's innovative capabilities.

Second, Nohria and Gulati (1996), in their research on organisational slack and its impact on innovation, suggest that resource slack promotes innovation, however at certain point the excess of resources reduces the discipline in selecting projects that generate most innovative outputs. With resource slack, projects may be initiated purely due to availability of resources rather than because of project's greatest innovative potential (Nohria and Gulati, 1996). We believe similar relationship may occur with overdiversification of funding sources as firms may fund most innovative ventures first, however with the ability to access finance, less innovative projects may also be funded.

Third, with access to broad and diverse external sources of financing, firms can overcome certain financing challenges and explore opportunities which may not be possible if financing is scarce. In the process of new product development, firms follow a three-stage process where they develop product visioning, align the R&D activities and commercialise the innovation (Aarikka-Stenroos et al., 2015). In the exploration phase of innovative activity firms focus on product visioning and alignment of R&D activity before they move to exploitation phase where they commercialise the innovation. However, to achieve ambidexterity in innovation activities, firms aim to exploit previously made investments (i.e. commercialisation) while continuously exploring new areas (i.e. product visioning or aligning R&D activities) by adding new competences or knowledge to search for new commercial opportunities (Li et al., 2008). However, simultaneous activity requires access to financial and non-financial (i.e. human capital) resources which may not be equally available at a firm level. Thus, achievement of organisational ambidexterity may not be viable for every firm (Senaratne and Wang, 2018). In the context of SMEs, Lubatkin et al.

(2006) argues that resource constraints may affect organisational ambidexterity as small firms have limited resources to effectively perform simultaneously both exploration and exploitation of innovative activities. Given that c47% of firms in our sample belong to a micro segment, we may argue that these firms will face challenges in achieving ambidexterity in innovation exploration and exploitation as they are likely to face greater resource challenges than larger firms. Thus, a sequential approach in exploration and exploitation of innovative activities may be preferable to ensure commercialisation of existing innovations is fully achieved before a new exploration is commenced. However, with the growing funding diversification firms may reduce their dependency on a single financier, reduce their financial constraints and potentially mitigate some of the resource limitations to support organisational ambidexterity. A broader access to external sources of financing may allow firms to align certain financiers to either exploration and others to exploitation of innovative activities. For instance, bank lenders (with stable return expectations) may wish to ensure exploitation (i.e. commercialisation) is sustained to ensure debt is paid back. On the contrary, high yield investors (i.e. venture capitalists, angel investors) may wish to build a solid pipeline of exploration activities to ensure firm valuation is increasing allowing for a better financial exit with a higher capitalisation. As diversification of funding base increases, firms may benefit from overcoming resource constraints as more financing is accessible. However, at a certain point, investors aligned to either exploration or exploitation may pull in a different direction due to their varying return expectations, thus negatively impacting firm's innovative performance (i.e. diminishing innovation). In addition, in a micro firm environment, ability to build exploration and exploitation capabilities may not necessarily be possible if a broader access to financing is achieved. Ability of firms to act in ambidextrous manner also depends on managerial abilities that need to effectively translate new resources into added benefit for the firm (Lubatkin et al., 2006). Therefore, in the context of our study we believe adding new financiers (i.e. diversifying and promoting access to external financing) will support simultaneous exploration and exploitation (i.e. ambidextrous activity) and in effect positively impact innovation. However, due to varying return expectations of different investors aligned to either exploration or exploitation activity, innovation may at certain point exhibit reducing or diminishing returns.

Finally, the inverted U-shaped relationship may suggest entrepreneurs consider firm's control rights as an additional factor affecting funding decisions. For instance, Aghion et al.

(2004), in the study on UK industrial firms, found evidence suggesting that R&D investing firms tend to use more debt than less R&D investing firms, as this strategy does not require giving up control rights as compared with the new equity issuance. However, Aghion et al (2004) note, that for highly attractive and innovative projects, at a certain point, firm's debt levels decline in favour of equity, as entrepreneurs will need to issue new equity to satisfy the investors participation demands in an attractive venture. Thus Aghion et al. (2004) suggest a possible non-linear relationship between innovation and debt finance and point in the direction of a dynamic relationship between firm's capital strategy and R&D intensity. Entrepreneur's decisions to select innovative projects may be impacted by balancing the varying needs of many financiers acting with diverse funding horizon and revenue timeline expectations (Bergemann and Hege, 2005). Hence, we stress the shape of the association between the innovation and diversification of funding changes with the increase in the degree of diversification due to managerial decisions on optimal financial resource allocation and participation in the revenue generation innovative ideas.

Thus, above arguments suggest a diminishing return from funding diversification on innovation activity, with initially improving innovation but hindering further performance if funding diversification is excessive beyond the optimal level. Hence, we suggest the relationship between funding diversification and innovation is curvilinear or inverse U-shaped. Accordingly, we formulate following hypothesis:

***H2*: Firms that over-diversify their funding base are less innovative**

## 3.3. Research Methodology

### 3.3.1. Sample

In 2015, email surveys were sent to Polish and Czech SMEs across four sectors: manufacturing, trade, services and construction. The total sampling frame of 2907 Polish and Czech SMEs was created by a specialised research agency[19] in a controlled manner in line with recommendations for online surveys, using third-party data base providers (Furrer and Sudharshan, 2001; Evans and Mathur, 2005). To select the sampling frame, we drew

[19] ABM Media (http://www.abmmedia.com.pl/)

representative random samples from four main industries (manufacturing, trade, services, construction) used by Central Statistical Office of Poland[20] as reference. The sample's representativeness was analysed by comparing the sampling frame with the distribution of SME population used by Central Statistical Office of Poland. This analysis revealed no significant differences between sampling frame and the target population. In total, 321 valid responses received (11% response rate); this represented a sampling error of 5.2% at the 95% confidence interval, which is within acceptable limits for survey research (Oerlemans *et al.*, 2006). The analysis of variance (ANOVA) between Polish and Czech data revealed no significant differences (see Appendix B).

Finally, to reduce the possibility of common method bias, some items in the questionnaire have been reversed. The anonymity of respondents has also been assured to enable truthful responses. In addition, The Harman's single-factor test was performed in which all variables were loaded into the factor analysis where the largest factor accounted for 11.8% of variance explained. In summary, a common method bias is not a major concern in this study (Podsakoff *et al.,*2003).

### 3.3.2. Questionnaire and variable construction

The questionnaire used in this research is based on the practice of previous studies (see Appendix C). Firms were asked about their company data, research and development activities, source of financing and co-operative ties over the past five years. Most questions are based on the 7-point Likert scale. The primary variables of interest are described below.

#### 3.3.2.1. Innovation (both product and process)

Previous studies often used categorical measures to capture innovative output, for instance distinguishing between radical (i.e. new) or incremental (i.e. improvements) for product or process innovations (e.g. De Propris, 2002). However, these types of innovation measures may often be misinterpreted by survey respondents as reliability of these measures are usually context dependent and rely on subjective assessments (Katila, 2000). This research follows Molina-Morales and Martinez-Fernandez (2006, 2009), and Tomlinson and Fai (2016), where respondents were asked questions on the number of new products introduced, alterations to existing products and changes to the production process over the last five years.

[20] http://stat.gov.pl/en/

These are frequency-based measures, and in line with Tomlinson and Fai (2016), questions asked in the survey aimed to cover for widest possible sphere of innovative activity rather than purely focusing on patents. The 7-point Likert scale was utilised, and firms were categorised in compliance with the EU guidelines[21]. In addition, mean scores across all the items listed in Appendix C together with the Cronbach's alpha (α) validation statistic have been calculated.

### 3.3.2.2. Diversified Funding Base

To capture the degree of funding diversification, SMEs were asked several questions to measure the current reliance on various finance instruments and ability to access them. The selection of variables was based upon Nofsinger and Wang (2011) in relation to external financing diversity, Kerr and Nanda (2014) in relation to the importance of bank lending to finance innovation, Engel and Keilbach (2007), Arvanitis and Stucki (2014) and Langeland (2007) in relation to venture capital financing, Molina-Morales and Martinez- Fernandez (2009) in relation to availability of trust & empathy to lending partners (which is important for firms to embrace the diversity of financing), and Klonowski (2012b) in regards to accessibility of governmental funding and firm's own capital. Survey questions were based upon 7-point Likert scale. Diversified Funding Base was constructed using the mean score across the items listed in Appendix C and Cronbach's alpha has also been computed.

### 3.3.2.3. Control Variables

To account for differences between firms, several control variables have been utilised. For instance, company size and spend on R&D activities are based upon Cohen and Levinthal (1990), Molina-Morales and Exposito-Langa (2012) and Yam *et al.* (2011). In addition, we use firm age and main owner share variables based upon Ortega-Argilés *et al.* (2005) and Laforet (2013). Finally, we control for country differences using country dummy variable, with Czech Republic being designated as the base.

[21] Based upon EU recommendation 2003/361 where staff headcount: (1) Medium-sized companies < 250; Small < 50; Micro < 10; (2) turnover or balance sheet total respectively: Medium-sized ≤ EUR 50m or EUR 43m; Small EUR 10m; Micro EUR 10m

### 3.3.3. Descriptive Statistics

Appendix D provides details of the descriptive statistics for all 321 SMEs used in the sample. For each construct, Cronbach's alpha (α) is reported, enabling the assessment whether items in the sample are related, or share a proportion of common variance. of 'convergent validity'. A high Cronbach's alpha score indicates that the sample of items performs well in capturing the construct which motivated the measure (Churchill, 1979, p. 68). In this study, all constructs showed Cronbach's alpha greater than 0.7, thus satisfying the condition for internal consistency and reliability (Nunnally, 1978; Clark and Watson, 1995; Morera and Stokes, 2016). The assessment of 'face validity', which analyses the theoretical reasoning for using particular scale items, was satisfied by utilising previously used multi-scale items, as discussed above and presented in appendix. In addition, the Variance Inflation Factors (VIFs) have been calculated to detect multicollinearity, a case when variance of regression coefficient is inflated because of collinearity (O'Brien, 2007). In summary, all VIFs demonstrate values close to 1, indicating that multicollinearity is unlikely an issue in this study (O'Brien, 2007).

### 3.3.4. Analytical Techniques

This study explores the impact of the diversified funding base on innovation and the analysis starts with the investigation whether significant differences exist between firms with low, medium or high funding diversification in relation to process, product and total innovation. Following the approach used by Tomlinson (2011), the sample has been split into three mutually exclusive groups of firms with low, medium and high funding diversification. First the mean scores have been calculated for items that were used to develop the 'Diversified Funding Base' construct in each firm. Then terciles have been calculated for the 'Diversified Funding Base' construct, allowing to divide the sample into three mutually exclusive groups. Finally, ANOVA was used as an analytical technique to compare means of the innovation variables between these three groups. In addition, the analysis has been conducted separately for Polish and Czech data and results are presented in the Results section below. The analytical software IBM SPSS Statistics v.22 has been used to perform all calculations.

### 3.3.5. Regression models and specification

Following the ANOVA, the study employs regression analysis based on the standard production functions supported by control variables (i.e. spend on R&D, company size, main

owner share, firm age). The country dummy variable was introduced with Czech Republic as the base. To explore the depth of the relationship upon innovation, we introduce a quadratic transformation of diversified funding base construct. The estimating equations are as follows:

(1) **Product Innovation** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Diversified Funding Base + $\beta 7$ Diversified Funding Base (squared) + $\varepsilon i$

(2) **Process Innovation** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Diversified Funding Base + $\beta 7$ Diversified Funding Base (squared) + $\varepsilon i$

(3) **Innovation (Product and Process)** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Diversified Funding Base + $\beta 7$ Diversified Funding Base (squared) + $\varepsilon i$

The above equations took the form of an inverted U-shaped (quadratic) regression with dependent variables being first regressed on control variables, second supplemented with independent variable diversified funding base, and finally enhanced by a squared diversified funding base variable.

## 3.4. Results

### 3.4.1. Analysis of Variance

ANOVA has been used to compare differences between the level of funding diversification and its impact on innovation. Three mutually exclusive samples have been created with high, medium and low funding diversification. For the aggregated sample, there are significant differences in means between the Low and High groups across Innovation Total and Process Innovation. There is no significant difference in means for Product Innovation. The following tables 1-3 provide the results of ANOVA.

Table 1. ANOVA (combined Polish and Czech sample)

| **PL&CZ *(N=320)*** | **Firms with low funding diversification *(N=118)*** | | **Firms with medium funding diversification *(N=103)*** | | **Firms with high funding diversification *(N=99)*** | | **F-test** | **eta (squared)** |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| Innovation Total | 3.7045 | 1.58998 | 3.8718 | 1.53798 | 4.1576 | 1.44258 | 2.387* | 0.01 |
| Process Innovation | 3.4587 | 1.68082 | 3.6408 | 1.62409 | 4.0337 | 1.53012 | 3.479** | 0.02 |
| Product Innovation | 4.0636 | 1.89076 | 4.2184 | 1.86909 | 4.3434 | 1.67156 | 0.645 | 0.00 |

***p<0.01; **p<0.05; *p<0.1

The condition of equality of variance for three groups has been met and assessed using Levene's test, concluding there are no significant differences in variance within analysed population (Gastwirth *et al*., 2009). In addition, coefficient eta-squared has been calculated as a measure of effect size. Eta-squared provides a proportion of total variance that is attributed to an effect and hence provides a popular measure to ascertain the degree of strength (Cohen, 1988; Lakens, 2013). Further to the benchmarks provided by Cohen (1988) the effect size is considered with low levels.

In the combined data, ANOVA provides interesting insights into the drivers behind the significant differences between high and low level of funding diversification. For instance, firms that increase their funding diversification by adding more debt financing from commercial banks seem to show significant better results in innovative capabilities. This is probably not surprising, as EBRD (2014) and OECD (2015a) already suggest a strong reliance of SMEs on debt finance within developing markets, and any increase in the level of accessibility of debt may contribute to capital structures supporting innovation.

Similarly, greater share and access to debt financing significantly contributes to improved product innovation. However, both greater level of trust and empathy towards lending institutions and greater access to governmental financing enables firms to exhibit significant better results in process innovation. The trust and empathy are relevant as they may relate to the importance of *relationship lending* suggested by EBRD (2014) which supports the argument that lending institutions engaged in *relationship lending* can exercise better judgement due to greater understanding of needs for a borrowing firm. Furthermore, analysing country data separately, there are significant differences in process innovation between firms with low and high funding diversification among Polish and Czech firms. However, there is no evidence for significant differences in means for product innovation and total innovation. This is in line with findings from EBRD (2014) suggesting that, where banking institutions ease credit constraints, firms in developing markets tend to produce improvements in the existing processes or enhancements to current products.

Tables 2 and 3 demonstrate the results for the Polish and Czech data individually.

Table 2. ANOVA (Polish sample)

| **PL *(N=282)*** | **Firms with low funding diversification (*N=96*)** | | **Firms with medium funding diversification *(N=94)*** | | **Firms with high funding diversification *(N=92)*** | | **F-test** | **eta (squared)** |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| Innovation total | 3.6979 | 1.59473 | 3.8468 | 1.54792 | 4.0848 | 1.44199 | 1.522 | 0.01 |
| Process Innovation | 3.4167 | 1.70928 | 3.6099 | 1.62980 | 3.9203 | 1.52342 | 2.293* | 0.02 |
| Product Innovation | 4.1198 | 1.86624 | 4.2021 | 1.89129 | 4.3315 | 1.63290 | 0.329 | 0.00 |

***p<0.01; **p<0.05; *p<0.1

Table 3. ANOVA (Czech sample)

| **CZ *(N=38)*** | **Firms with low funding diversification *(N=22)*** | | **Firms with medium funding diversification *(N=9)*** | | **Firms with high funding diversification *(N=7)*** | | **F-test** | **eta (squared)** |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| Innovation total | 3.7333 | 1.60594 | 4.1333 | 1.48997 | 5.1143 | 1.14226 | 2.229 | 0.11 |
| Process Innovation | 3.6508 | 1.56871 | 3.9630 | 1.61971 | 5.5238 | 0.50395 | 4.404** | 0.21 |
| Product Innovation | 3.8182 | 2.02099 | 4.3889 | 1.70986 | 4.5000 | 2.27303 | 0.45 | 0.03 |

***p<0.01; **p<0.05; *p<0.1

## 3.4.2. Non-linear regression models

All models are well specified (see table below) and the *R-squared* statistics are in line with multivariate regression results in innovation studies. In each of the 1-3 regression models the *R-squared* statistic improves when adding the predictor variables. The evidence of a curvilinear relationship has been found for product and total innovation. However, in non-quadratic function, regression results show positive signs against diversified funding base construct indicating positive influence on innovation (i.e. product, process and total innovation). While the evidence of curvilinear relationship has not been confirmed for process innovation, adding the 'Diversified Funding Base' measure significantly increases R-square across all three models. In addition, the country dummy in process innovation shows significant values indicating Polish firms demonstrate lower process innovation estimates as compared with Czech SMEs. In all three models, the company size and spend on R&D remain significant and have a positive impact on innovation. In addition, across product, process and total innovation, company size remains significant at 1% for 50-99 employee level (see Appendix E). Remaining two control variables main owner share and firm age, have not shown significant influence across the analysed models.

The summary of multivariate regression results and curvilinear relationship are presented in the tables below.

Table 4. Multivariate regression analysis (dependent variable: product & process innovation)

| Variable | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| β0 | 2.406 (0.398)*** | 1.958 (0.443)*** | 1.061 (0.655)* | 0.312 (1.338) |
| Spend on R&D | 0.389 (0.056)*** | 0.385 (0.056)*** | 0.393 (0.056)*** | 0.392 (0.56)*** |
| Company Size | 0.215 (0.07)*** | 0.202 (0.069)*** | 0.186 (0.07)*** | 0.183 (0.70)*** |
| Main owner share | 0.029 (0.047) | 0.037 (0.047) | 0.049 (0.047) | 0.050 (0.047) |
| Firm Age | 0.004 (0.005) | 0.004 (0.005) | 0.004 (0.005) | 0.004 (0.005) |
| Polish Firms | -0.29 (0.25) | -0.388 (0.252) | -0.428 (0.252)* | 0.506 (1.402) |
| Czech Firms | | *(reference category)* | | |
| Diversified Funding Base | | 0.171 (0.076)** | 0.858 (0.379)** | 1.347 (1.031) |
| Diversified Funding Base$^2$ | | | -0.115 (0.062)* | -0.179 (0.185) |
| Diversified Funding Base * Poland | | | | -0.602 (1.098) |
| Diversified Funding Base$^2$ * Poland | | | | 0.079 (0.195) |
| Adjusted $R^2$ | 0.146 | 0.157 | 0.163 | 0.160 |
| F statistic | 11.869*** | 10.858*** | 9.870*** | 7.721*** |
| *N = 321* | | | | |

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

Table 5. Multivariate regression analysis (dependent variable: product innovation)

| Variable | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| β0 | 2.482 (0.481)*** | 2.31 (0.539)*** | 0.959 (0.794) | -0.756 (1.620) |
| Spend on R&D | 0.413 (0.068)*** | 0.411 (0.068)*** | 0.422 (0.068)*** | 0.422 (0.068)*** |
| Company Size | 0.215 (0.084)** | 0.210 (0.084)** | 0.185 (0.085)** | 0.176 (0.085)** |
| Main owner share | -0.002 (0.057) | 0.001 (0.057) | 0.018 (0.057) | 0.023 (0.057) |
| Firm Age | 0.004 (0.006) | 0.005 (0.006) | 0.004 (0.006) | 0.005 (0.006) |
| Polish Firms | 0.037 (0.302) | -0.001 (0.307) | -0.061 (0.306) | 1.910 (1.697) |
| Czech Firms | | *(reference category)* | | |
| Diversified Funding Base | | 0.065 (0.092) | 1.101 (0.459)** | 2.593 (1.249)** |
| Diversified Funding Base$^2$ | | | -0.174 (0.075)** | -0.446 (0.224)** |
| Diversified Funding Base * Poland | | | | -1.692 (1.330) |
| Diversified Funding Base$^2$ * Poland | | | | 0.306 (0.236) |
| Adjusted $R^2$ | 0.113 | 0.111 | 0.123 | 0.122 |
| F statistic | 9.068*** | 7.627*** | 7.385*** | 5.925*** |
| *N = 321* | | | | |

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

Table 6. Multivariate regression analysis (dependent variable: process innovation)

| Variable | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| β0 | 2.329 (0.431)*** | 1,673 (0.478)*** | 1.027 (0.711) | 0.538 (1.510) |
| Spend on R&D | 0.375 (0.061)*** | 0,370 (0.06)*** | 0.376 (0.06)*** | 0.375 (0.60)*** |
| Company Size | 0.217 (0.075)*** | 0,199 (0.074)*** | 0.188 (0.075)*** | 0.187 (0.075)*** |
| Main owner share | 0.048 (0.051) | 0,06 (0,05) | 0.068 (0.051) | 0.067 (0.051) |
| Firm Age | 0.003 (0.005) | 0,004 (0,005) | 0.004 (0.005) | 0,004 (0.005) |
| Polish Firms | -0.483 (0.272)* | -0,615 (0.272)** | -0.639 (0.272)** | 0.045 (1.571) |
| Czech Firms | | *(reference category)* | | |
| Diversified Funding Base | | 0,245 (0.081)*** | 0.735 (0.408)* | 0.822 (1.146) |
| Diversified Funding Base$^2$ | | | -0.082 (0,067) | -0.046 (0.203) |
| Diversified Funding Base * Poland | | | | -0.180 (1.214) |
| Diversified Funding Base$^2$ * Poland | | | | -0.027 (0.213) |
| Adjusted R-squared | 0.124 | 0.147 | 0.148 | 0.147 |
| F statistic | 10.010*** | 10.074*** | 8.863*** | 7.080*** |

N = 321

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

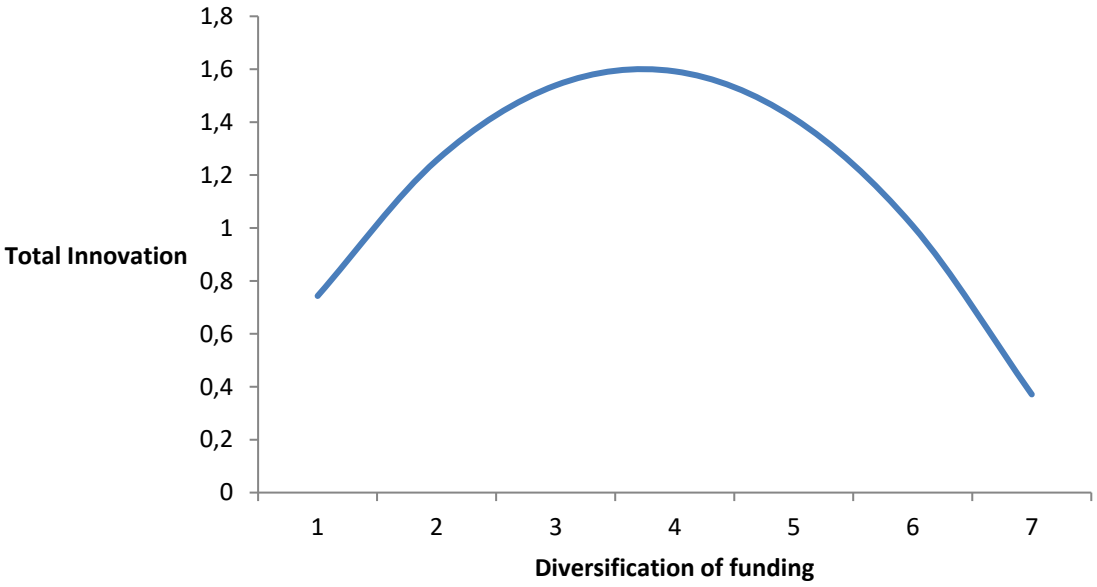
Table 7. Summary results – curvilinear relationship

| | **Evidence of linear relationship** | **Evidence of curvilinear relationship** |
|---|---|---|
| **Process Innovation** | **Yes** | **No** |
| **Product innovation** | **Yes** | **Yes** |
| **Total innovation** | **Yes** | **Yes*** |

*at 10% significance

For product innovation, the innovation is at its maximum when the Diversified Funding Base coefficient is at the level of 3.164. After this point product innovation decreases. Total Innovation (product & process) is at its maximum when the Diversified Funding Base coefficient reaches the level of 3.73 and after this point the total innovation decreases. The following graph provides a visualisation of the curvilinear relationship.

**Figure 1. Curvilinear Relationship for Diversified Funding Base and Total Innovation constructs**




Finally, following the techniques outlined by Aiken and West (1991), Column 4 in Tables 4,5 and 6, provides the results of the estimations using the interaction terms between country dummy and diversified funding base, diversified funding base (squared) across product, process and composite innovation measures. The reported results are relative to Czech Republic (which acts as a base) and demonstrate slightly lower adjusted R-squared values as compared with Column 3, without inclusion of multiplicative dummies. We interpret the results with caution as inclusion of multiplicative dummies may raise a possibility of multicollinearity, which may affect the levels of individual coefficient significance (Greene, 2008). Interestingly, the results for interaction terms show the lack of significant values across diversified funding base (incl. squared variables) across the analysed three innovation measures. Thus, it appears that in the case of all innovation measures used in this study, diversified funding base is not influenced or dependent on country specific factors.

We also note some interesting differences between Polish and Czech firms. For the composite innovation measure, Polish firms show significantly lower innovative values (at 10% significance level) as compared to Czech firms. This seems to be driven by the significant differences in process innovation where Polish firms in average show 0.639 lower innovation values as Czech counterparts (at 5% significance level). While the company size and spend on R&D also show significant values (at 1% level) we infer that differences in Polish and Czech firms do not stand from either size or amount of spend towards R&D. As the adjusted R-squared explains approximately 16% of the variance, we believe that other

factors, not-captured within the regression model, may drive the differences in innovation levels between Polish and Czech firms.

## 3.5. Discussion

In this paper, we have demonstrated that 'Diversified Funding Base' is a valid and reliable measure that has a significant effect on innovation in Czech and Polish SMEs. In this section, we discuss the practical and theoretical implications of our analysis.

The analysis of funding diversification is especially interesting in the context of capital structure discussions and implications on innovation. The evidence found in this research suggests that increase in diversification of funding base has a positive impact on innovative capability of SMEs. Hence, the first hypothesis (H1) is supported. While this evidence is novel, it aligns with the recommendations of OECD (2015a) highlighting the need for SMEs to broaden their finance providers to overcome systemic risks and accelerate growth. It also aligns with the findings of Bartoloni (2013), in which an increase in innovative effort is linked with the higher share of external finance of a firm. Especially in the context of large innovative projects, where internal financing is constrained, broadening of access to external finance is essential and may contribute to positive innovative outputs (Bartoloni, 2013). Our results are also in alignment with Magri (2009) who draw similar conclusions for Italian SMEs, suggesting that innovative SMEs should expand their capital structure to include external sources to reduce the reliance on internal funds.

Turning to the second hypothesis, we find evidence for a curvilinear relationship. Hence, our hypothesis (H2) relating to funding overdiversification effects on innovation is supported. Interestingly, the composite innovation measure is clearly influenced by the curvilinear evidence within product innovation and we are unable to confirm similar curvilinear relationship for process innovation. The implications here are twofold.

First, exploring product versus process dynamics, most capital providers (including banks) look at products rather than process when making decisions to invest as they focus on tangible collateral first (e.g. Deffains-Crapsky and Sudolska, 2014). Hottenrott and Peters (2012) argue that resource requirements may drive the decision to invest in innovative products, Hence, availability of financing resources may, at a certain point, become a less critical factor in deciding whether to expand in the development of innovative product. Kraft (1990) found evidence for a positive impact of product innovation on process innovation.

Damanpour and Gopalakrishnan (2001) note that organisations emphasize the adoption of product innovation over process innovation as managers perceive products to be more easily protected by patents (or legal mechanisms) whereas process innovations are rather firm specific and drive production efficiencies. The results of our study suggest that there is a dynamic relationship between product versus process innovation. With the growing funding diversification firms support both product and process innovation, hence our results are in line with suggestions of Damanpour and Gopalakrishnan (2001) on synchronous adoption of both innovation types. However, at certain point the growing funding diversification contributes to the decrease in product innovation (evidence of curvilinear relationship), while at the same time positively impacting process innovation (evidence of linear relationship) as firms continue to focus on process improvements to enhance production efficiency.

Second, the evidence of curvilinear relationship points in the direction of a dynamic relationship between firm's capital structure and corporate strategy. There could be several reasons for our findings. For instance, an argument of ''too many cooks spoil the broth'' could find some grounds as O'Brien (2003) suggests that there is a dynamic relationship between firm's capital structure and corporate strategy, whereas an innovative capability could be impacted with the growing level of leverage. In addition, some reasons of curvilinearity from Kochhar and Hitt (1998) and Dong *et al.* (2013) discussed earlier may suggest there are financier's difficulties to control the borrowing firm or challenges to satisfy the needs of capital providers often pulling in different directions. Some of these arguments may be related to our study as most of the surveyed SMEs are predominantly dependent on debt finance and commercial banks' ability to monitor borrowing firm's activity is likely dominant in the early stages of financing. We find that the incremental impact on innovation is likely greatest in initial stages of financing with diminishing rate during the later phases of financing or when additional financiers are added. With growing number of financiers often with varying time and return expectations, SME managers may focus on highest innovating ideas first followed by often less developed initiatives diluting innovative capabilities and contributing to the inverted U-shaped relationship. This may also align with the suggestions from Nohria and Gulati (1996) on resource slack, whereas over-accessibility of resource may lead to inefficiencies in its allocation.

Furthermore, the evidence of diminishing returns in over-diversification of funding base, may in some element relate to how micro firms align their innovation exploration and

exploitation activities. In the context of our study we believe adding new financiers (i.e. diversifying and promoting access to external financing) will support simultaneous exploration and exploitation (i.e. ambidextrous activity) and in effect positively impact innovation. However, due to varying return expectations of different investors aligned to either exploration or exploitation activity, innovation may at certain point exhibit reducing or diminishing returns

The outcome of this research aligns with findings from OECD (2015a; 2015b) suggesting that SMEs are more reliant on bank debt to finance innovation and growing availability of financing from commercial banks within the funding base will positively impact the innovative capability of SMEs. However, it is also worth noting that diversification of funding methods may have a different nature in more developed markets as compared to emerging economies of Poland and Czech Republic. As noted by OECD (2015a), Polish or Czech SMEs are frequently not familiar with new financing methods available on more sophisticated markets (e.g. venture capital, asset-based finance, hybrid investments, alternative debt etc.) hence potential diversification effects in developed countries could be more significant. Moreover, even if SMEs from both Poland and Czech Republic are familiar with innovative funding methods, these are rarely offered on the capital markets in CEE region (OECD, 2015b).

Furthermore, in the context of analysed CEE economies, both markets experience a considerable SME financing gap and are constrained to expand beyond traditional financing sources (Qi and Ongena, 2019). A relative high share of foreign-owned banks operating in Poland and Czech Republic may impact the accessibility of SME bank credit during financial crises if foreign parent institutions are affected and reduce their international exposures. Therefore, the link between availability of bank debt and innovation may even be more intense in markets (e.g. within CEE region) that are heavily dependable on bank lending (Qi and Ongena, 2019). Thus, the evidence found in this research on positive effects of finance diversity on SME innovation is especially relevant in CEE markets context due to potential shortage of alternative financing options and SME financing gap.

This research supports the suggestions of OECD (2015b) that policy makers should encourage long-term investors to access the SME finance market to offer opportunities to support sustainable innovative activities in less financially advanced markets of CEE region. This however, highlights the importance of the institutional environment, as suggested by

Nofsinger and Wang (2011), promoting access to diverse external financing, as it contributes to the reduction of agency costs, improvements in contract enforcement and thus strengthens the investor protection. Lastly, we align with OECD (2015b) suggestions that non-bank lending may help investors to diversify their portfolios while enabling SMEs to benefit from new ways to fund their businesses. While this hypothesis seems sensible at first sight, it does come with several caveats related to financing costs and its accessibility. For instance, level of investments associated with some of the financial instruments (e.g. venture capital) have not yet returned to levels before 2007/8 financial crisis (OECD, 2015a). Hence, the importance of co-ordinated measures from policy makers is becoming more crucial to build foundations for institutional environments promoting and enabling access to diverse funding methods.

It is important to recognise our results considering the size and industry categorisations used in this research. As presented in Section 2.7, c46% of firms in our research belong to the micro segment. Thus, certain financing discussions considering the firm size could lead to specific interpretations regarding the *diversified funding base* concept introduced in this study. In terms of financing preferences, Daskalakis et al. (2013) recognised the unique characteristics of micro firms in the way they search for financing. For instance, in the example of Greek micro segment, most firms tend to use equity financing (firm's own funds), are reluctant to expand into more sophisticated products such as venture capital and are keen to expand into long-term debt financing (Daskalakis et al., 2013). For small firms, ability to expand their sources to external financing is constrained more than for larger firms, especially in the conditions where institutional environment or property rights are less protected (Beck et al., 2008). Institutional reforms promoting more effective legal systems, protection rights and enforcement capabilities create environments that support smaller firms in expanding to external sources of finance (Beck et al., 2008). In the context of Czech Republic, micro firms are more financially constrained than small or medium firms, however they can moderate financing challenges by enhanced collateral or higher quality credit information provided to lenders to secure external financing (Rahman et al., 2017).

In our study we provide evidence for diversification effects on product and process innovation and diminishing returns on product innovation. Considering that almost half of the sample is represented by micro firms, the results provide further interesting insights. First, in line with Kumar and Rao (2016) we note that micro firms are dependent on bank lending and its share in overall financing is likely to decrease as a focal firm expands in size.

As firm grows and overcomes information asymmetries, the options for external financing are expanding (Kumar and Rao, 2016). However, Goujard and Guérin (2018) in the OECD study note, that the availability of options on the market will depend on the policy makers to ensure market-based conditions are created (e.g. improvements in insolvency laws, labour mobility, regulatory burden, etc.).

Second, expanding the access to financing is important in the context of our study as it supports diversification of financing means for smaller and micro firms, hence positively impacting innovation. However, financing decisions of micro firms should also be considered in terms of the transfer of control rights when new financiers are added. As micro firms tend to source financing using pecking order theory (i.e. beginning with retained earnings, firm's own capital, etc.), the growing share of external finance may represent a challenge as firm owners would need to transfer some of the equity ownership to external financiers (Bornhäll et al., 2016). With the higher share of external financing in the firm, the control rights are transferred to external financiers, leading to a situation where firm managers may have limited autonomy to pursue certain innovative activities. For instance. with external financing more aligned towards stable returns payback (i.e. bank financing), an innovative owner-manager may not be able to expand into more risky innovative ideas. With that in mind and building on the results of our study, we may argue that diminishing returns in product innovation may in some element relate to a reducing autonomy of firm-owners in pursuing certain innovative (i.e. riskier) activities.

Finally, we note some interesting differences between Polish and Czech firms. While we observe significant lower values of process and total innovation for Polish firms we believe these differences are explained in other factors, not related to funding diversification, company size or spend on R&D. Furthermore, through the results of multiplicative dummy analysis we also find that the impact of funding diversification on three measures of innovation is not dependent on (or influenced by) the country specific factors. Overall, the econometrical results are in line with our theoretical expectations and provide interesting insights into the analysis of innovation in emerging markets. In short, our results deepen our understanding of the dynamic relationship between firm's innovation levels and corporate funding strategy.

## 3.6. Conclusion

The purpose of this research was to understand whether the 'Diversified Funding Base' construct is both a valid and reliable measure, and whether it significantly influences the innovative capability of Polish and Czech SMEs. This study explored the significance of the diversified funding base, and its impact on innovation. This is novel, as previous research focused predominantly on the importance of access to finance to support growth and innovation (e.g. Hyytinen and Toivanen, 2005; Beck and Demirguc-Kunt, 2006; Lee et al., 2015) or barriers to innovation (e.g. scarce resources or financing) which lead to undermining the development of innovative products or processes (e.g. Norek and Arenhardt, 2015; Walicka, 2014). Furthermore, our research provides a contribution, as existing literature largely focuses on analysing single financing methods affecting innovation (e.g. Wang et al. 2015; Bis, 2009; Mina et al. 2013). While some scholars recognised the need to analyse the combined impact of different types of financing methods on innovation (e.g. Bergemann and Hege, 2005; Mina et al. 2013) there is limited research on how diversifying the access to various funding sources may impact innovation of SMEs. Our research aims to close this gap by investigating innovation in the context of a diversified funding base while controlling for country specific impacts (focusing on evidence from Polish and Czech SMEs).

In summary, the outcome of this research adds to the existing literature by providing empirical evidence on the relationship between *diversified funding base* and innovation, and thus offers a further dimension to the framework in which to assess influences on innovation among SMEs in developing markets. The results deepen our understanding about perceptions of SME managers on the accessibility, dependency and thus diversification of funding methods to support innovation, hence this research makes several contributions.

First, by studying the relationship between funding diversification and its impact upon innovation, we add additional aspect to the literature on innovation sources. With the results suggesting that growing level of funding diversification positively impacts innovation, we derive managerial implications in which SME managers searching for new means to enhance their innovative output, shall consider broadening their access to finance sources as one of the factors accelerating their R&D productivity. In alignment with the OECD (2015b) recommendations, our paper suggests that policy makers should remove blockages for SMEs to access capital markets to tap into more sophisticated financial instruments. In addition,

policy makers should encourage long term investors to access the CEE region to diversify their portfolios but also to add opportunities for SMEs to reduce their financial reliance on traditional bank financing. This presents interesting areas for future research. For instance, OECD (2015b) suggest a linkage of long-term investment and innovative capabilities of SMEs. While this research confirmed that SMEs are reliant on rather long-term financing it had not specifically addressed the sensitivities of innovation in relation to SME finance time horizon. Therefore, a study to understand the profile of innovative capabilities looking at the lending tenure of different finance providers (e.g. short-term / long-term/ project-based / phase-based) may provide further insights into a preferred diversified mix of finance instruments to optimise innovative capabilities of an enterprise. At an entrepreneurial level, this study supports suggestions of Hagel (2013) to enhance the role of finance department within firms to act with a more business-oriented mind-set to promote innovation.

Second, by analysing the over-diversification of funding base, we build a link to capital structure literature, and contribute to the discussion on finance choices to support R&D productivity. The evidence of a curvilinear relationship sets a foundation for further studies in diversification of finance sources and its implications on firm's R&D productivity. By analysing the funding sources available within a diversification level, future studies can explore, theoretically, empirically, and practically, trade-offs relating to specific finance instruments, which could lead to managerial or policy maker's implications to enable access to more sophisticated finance instruments.

Finally, there are methodical limitations in this research. First, the definition of the 'Diversified Funding Base' construct used in this research is represented by finance instruments most commonly used within analysed markets. As presented by Churchill (1979) variations in construct definitions may lead to challenges in comparing results in empirical studies. Hence, research on diversified funding base and its impact on innovative capability may not be easily comparable if constructs definitions are different. Hence, future studies may enhance the construct definition to include a broader variety of funding methods: for instance, by incorporating alternative finance instruments (e.g. securitisation, hybrid investments, angel financing, etc.) or by narrowing the construct definition to focus on trade-offs between specific instruments (e.g. equity finance versus debt finance; venture capital versus. hybrid investments; etc.). Building on this research, future studies could emerge into game theoretic application on such possible trade-offs in the degree of funding diversification to *optimise* the innovative output of a firm. Furthermore, while this study

analysed diversified funding position by measuring the accessibility and firm's dependency on each financing instruments in the overall funding position, future studies may also look to include the number or specific characteristics of financing instruments as a main indicator of the level of diversification.

The second limitation relates to the SME segmentation from Poland and Czech Republic. While most firms in this study come from the micro segment (less than 10 employees), it would be interesting to assess whether the results can be extrapolated to the general SME population across both analysed markets. Future studies could address specific firm size clusters and sectors in the context of funding diversification and explore whether some business sectors (e.g. manufacturing, IT, etc.) are showing evidence for greater propensity to use diversified capital base and whether it has a significant impact upon innovation.

To conclude, this research aimed to add *diversified funding base* as one of the additional measures in the studies on innovation and build foundations for future studies in this research area. The results of this study suggest that SMEs are subject to optimisation decisions, in relation to access and dependency on finance methods, which potentially lead to varying effects on innovation. Without adequate attention and capabilities to assess optimal funding diversification, managers may unintentionally engage in strategies that could translate into sub-optimal innovation levels.

## 3.7. Appendix

### 3.7.1. Appendix A – Industry structure of the dataset

| Industry | n | % |
|---|---|---|
| Production | 92 | 28.66% |
| Construction | 33 | 10.28% |
| Retail and Wholesale | 34 | 10.59% |
| Hotels and restaurants | 1 | 0.31% |
| Transport | 2 | 0.62% |
| Telecommunications | 8 | 2.49% |
| Financial Services | 23 | 7.17% |
| Health | 2 | 0.62% |
| Other | 126 | 39.25% |
| **Total** | **321** | **100%** |

### 3.7.2. Appendix B – ANOVA on control variables for Polish and Czech data

| Control Variables | | N | Mean | Standard Deviation | Std. mean error | t-Test |
|---|---|---|---|---|---|---|
| Spend on R&D | Poland | 282 | 2.88 | 1.429 | .085 | 1.725 |
| | Czech Republic | 39 | 2.46 | 1.335 | .214 | |
| Company size | Poland | 282 | 1.92 | 1.213 | .072 | -0.743 |
| | Czech Republic | 39 | 2.08 | 1.494 | .239 | |
| Main owner share | Poland | 282 | 4.74 | 1.677 | .100 | -0.731 |
| | Czech Republic | 39 | 4.95 | 1.776 | .284 | |
| Firm Age | Poland | 282 | 23.91 | 18.63 | 1.10946 | 0.663 |
| | Czech Republic | 38 | 21.84 | 13.26 | 2.15195 | |

### 3.7.3. Appendix C – Variable construction (survey items used)

**Product Innovation**: (1) The number of new product lines introduced, (2) the number of changes/improvements to existing product lines.

**Process Innovation:** (1) The Number of new equipment/technology introduced in the production process, (2) the number of new input materials introduced in the production

process, (3) the number of organisational changes/improvements made in the production processes (based upon: Molina-Morales and Martinez- Fernandez, 2006, 2009; Tomlinson and Fai (2016)). Scale 1-7; where 1 = None, 2 = low level, and 7 = A great many etc.

**Company size:** Based on number of employees with categories: less than 10, 10-49, 50-99, 100-149, 150-199, 200-250, greater than 250. Based upon Yam et al. (2011). Although firms with greater number of employees than 250 are not considered SMEs per EU definition, the survey enables this response as a method of control. Based upon Ortega-Argilés et al. (2005)

**Spend on R&D:** Percentage of firm's turnover spend on R&D (including product, process and activities developed in-house or in collaboration); Scale from 0%, 1-5%, 6-10%, 11-20%, 21-30%, greater than 30%. Based upon Tomlinson and Fai (2016)

**Firm Age:** companies were asked to specify the year of the start of firm's activities. To compute the age, items were subtracted from the year 2017. Based upon Ortega-Argilés et al., (2005)

**Share of main owner:** scale from: less than 25%; 25%-50%; 50%; 50%-75%; 75%-100%; 100%. Based upon Ortega-Argilés et al. (2005)

**Diversified Funding Base:** (1) Dependency on financing from more than 3 sources (incl. own funds), (2) Dependency on Debt financing from the commercial banks, (3) Dependency on Funding from governmental agencies, (4) Dependency on Venture capital financing, (5) Accessibility of external debt finance from commercial banks, (6) Accessibility of venture capital investors, (7) Availability of trust and empathy towards lending partners, (8) Accessibility of governmental financing; Scale: 1 (strongly disagree) - 7 (strongly agree). Based upon Engel and Keilbach (2007); Arvanitis and Stucki (2014); Langeland (2007); Nofsinger and Wang (2011); Klonowski (2012b); Molina-Morales and Martinez- Fernandez (2009)

## 3.7.4. Appendix D – Descriptive Statistics

| *N=321* | Mean | Standard Deviation | Cronbach's Alpha | Variance Inflation Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Innovation | 3.9066 | 1.53998 | 0.848 | N/A | 1 | | | | | | | |
| Process Innovation | 3.7031 | 1.63205 | 0.798 | N/A | .928** | 1 | | | | | | |
| Product Innovation | 4.2087 | 1.82047 | 0.825 | N/A | .867** | .619** | 1 | | | | | |
| Diversified Funding Base | 3.0105 | 1.06914 | 0.723 | 1.049 | .134* | .164** | .067 | 1 | | | | |
| Firm Age | 23.66 | 18.07 | N/A | 1.209 | .071 | .061 | .070 | -.040 | 1 | | | |
| Spend on R&D | 2.83 | 1.423 | N/A | 1.024 | .339** | .304** | .311** | .057 | -.100 | 1 | | |
| Company Size | 1.94 | 1.248 | N/A | 1.201 | .169** | .160** | .143* | .050 | .404** | -.057 | 1 | |
| Main owner share | 4.76 | 1.688 | N/A | 1.007 | .006 | .028 | -.027 | -.094 | -.042 | -.053 | -.040 | 1 |

**p<0.01 ; *p<0.05

## 3.7.5. Appendix E – Company Size analysis

| | | Innovation | | Process Innovation | | Product Innovation | |
|---|---|---|---|---|---|---|---|
| ***Employee number*** | **N** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** |
| Fewer than 10 | 150 | 3.55667 | 1.548691 | 3.3736 | 1.65578 | 3.8233 | 1.87543 |
| 10-49 | 100 | 4.06400 | 1.491763 | 3.8300 | 1.57527 | 4.4150 | 1.69529 |
| 50-99 | 42 | 4.50317 | 1.465794 | 4.2222 | 1.66042 | 4.9167 | 1.61893 |
| 100-149 | 14 | 4.50000 | 1.141524 | 4.4286 | 1.15046 | 4.6071 | 1.49587 |
| 150-199 | 6 | 4.233 | 2.099206 | 4.2222 | 1.86984 | 4.2500 | 2.54460 |
| 200-249 | 3 | 5.000 | 1.509967 | 4.7778 | 1.07152 | 5.3333 | 2.88675 |
| greater than 250 | 6 | 3.600 | 0.903327 | 3.3889 | 1.10387 | 3.9167 | 1.56258 |
| ***Total*** | **321** | **3.91** | **1.54** | **3.7031** | **1.63205** | **4.2087** | **1.82047** |
| | | | | | | | |
| ***F-test*** | | **3.339*** ** | | **2.723*** ** | | **2.814*** ** | |
| significant at 1% level | | 50-99 employees | | 50-99 employees | | 50-99 employees | |

***p<0.01; **p<0.05;
*p<0.1

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# 4. Paper Two: Co-operation

| **This declaration concerns the article entitled:** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Intensity and Breadth of Interfirm Co-operation and its Impact on SME Product and Process Innovation. Evidence from Poland and Czech Republic. | | | | | | | | | |
| Publication status (tick one) | | | | | | | | | |
| Draft | ✓ | Submitted | | In review | | Accepted | | Published | |
| Publication details (reference) | The current paper is in an advanced draft form ahead of the submission to one of the ABS-4 grade journals. If accepted, the reference would read:<br><br>Kelles-Krauz, K.M., Tomlinson, P.R., & Fairchild, R., 2019. Intensity and breadth of interfirm co-operation and its impact on SME product and process innovation. Evidence from Poland and Czech Republic | | | | | | | | |
| Candidate's contribution to the paper (detailed, and also given as a percentage) | The candidate considerably contributed to the:<br><br>**Formulation of ideas:** 70%. I formulated the research question which then was refined with the help of the second author. I explored the literature on co-operative activities and analysed concepts of breadth, depth and over-engagement in co-operating activities. I have discussed the ideas with the second and third author and included their remarks. Subsequently, I created the initial draft which was revised with the help of the second and third authors. Post initial reviews I have refined the paper before we each accepted the version of the paper.<br><br>**Design of methodology:** 60%. I constructed and refined the questionnaire, based on the earlier similar studies in the literature and advices from the second author. In the methodological section, I developed each of the variables from the survey questions and ran all the statistical analyses in SPSS software. Doing so, I have used methodological support from the second and third authors.<br><br>**Experimental work:** 90%. I alone conducted the survey, liaised with the third party conducting the online survey and I alone analysed the results of the data.<br><br>**Presentation of data in journal format:** 70%. While preparing the paper I followed the guidelines for journal publications ensuring the presentation would be acceptable and at the standard required for a ABS-4 grade journal. I have taken recommendations from second and third author when refining the paper. | | | | | | | | |
| Permission | At the time of this PhD submission, the paper is in a draft form ahead of the submission to one of the ABS-4 grade journals. At this stage no permission is required from any journals. | | | | | | | | |
| Candidate Statement | This paper reports on original research I conducted during the period of my Higher Degree by Research candidature. | | | | | | | | |
| Signed | *Kazimierz M Kelles-Krauz* | | | | Date | 30/11/2018 | | | |

# Intensity and Breadth of Inter-Firm Co-operation and its Impact on SME Product and Process Innovation. Evidence from Poland and Czech Republic

**Abstract**

In the context of intercompany co-operating activities, the ‘’network of actors’’ has been often described as a catalyst for firms’ innovative performance. While firms increasingly search for new ways to expand their business activities, inevitably they are required to embed within the networks along their supply chain. The existing literature has demonstrated the importance of co-operation within the context of innovative studies noting the ‘’embeddedness in networks’’ as a factor that may result in differing impact on innovative return. We explore this concept by focusing on SMEs from Central and Eastern European markets. Using unique survey data from 321 Polish and Czech Small and Medium Enterprises we construct multi-scalar and multi-dimensional measures of upstream and downstream co-operation and measure their impact on both product and process innovation. Using multivariate analysis, we find the dynamic relationships between downstream co-operation and product innovation with over-engagement in buyer networks contributing to curvilinearity. Our findings suggest firms should evaluate the extent in which they engage in co-operating activities to optimise their up / downstream relationships fostering most efficient product / process innovation levels.

## 4.1. Introduction

The stimulation of innovative thinking appears often on the top of manager’s priorities within business enterprises. Firms co-operate leveraging their comparative advantage or subcontract to firms with more efficient production / service capabilities (Berry, 1997). Furthermore, SMEs frequently act as significant partners in value chain creation for larger firms and strive to remain competitive in globalised economy by creating co-operative arrangements with existing and prospective partners within the supply chain (Potocan and Mulej, 2009). The increased global competition requires that policy makers enable firms to

engage within co-operating activities not only relying on relative cost factor advantages but also on institutional and production capabilities (Kraetke, 1999). The collaboration between firms can significantly improve their performance and overcome some of the constraints, especially labour and demand shortage (Hessels and Parker, 2013).

The way firms innovate are often categorised by (1) *breadth* referred to number of co-operative relationships (Laursen and Salter, 2006) and (2) *depth* represented as intensity of the engagement with each partner (Laursen and Salter, 2006; Keupp and Gassmann, 2009). Some scholars note that tie breadth and tie strength are complementary in innovation and that analysis of both needs to be set within certain contexts (e.g. Kowlaser and Barnard, 2016; Bahemia et al., 2017). For instance, Kowlaser ad Barnard (2016) argue that whilst innovation happens pre-dominantly in teams, the *location* is another important factor affecting innovation. Bahemia (et al., 2017) recognises the importance of *partner newness* having direct positive impact on innovation. However, little research exists that would systematically and simultaneously explore breadth and depth of relationships in the context of *dyadic up and downstream supply chain relationships*, especially for the Central and Eastern European (CEE) economies. While there are number of papers discussing either breadth of strength of ties separately, this paper aims to assess them both including the potential over-embeddedness in the context of product and process innovation, while focusing on CEE economies.

The study on Polish and Czech SMEs is especially interesting as CEE economies have seen a continuous growth in innovativeness and internationalisation of domestic firms (Lewandowska et al., 2016). Together with the growing new to market product innovations (OECD, 2017), studies on both Poland and Czech Republic represent an interesting but also under-researched field in the context of innovation collaboration within dyadic up and downstream supply chain relationships. Both markets have been selected from the cluster of CEE economies as they both achieved superior economic transition, face similar challenges in access to financing and demonstrate relatively low inter-firm collaboration as compared with more advanced EU economies. As both Poland and Czech Republic are re-aligning their strategies from innovation-importing towards innovation-creating economies, more efforts will need to be placed on developing deep and broad collaborative arrangements along the supply chain.

In our study, we use survey data from SMEs in two CEE economies to explore effects of supply chain collaboration on product and process innovation. With unique set of data on dyadic relationships with both main buyers and main suppliers we explore the *depth* of the association and differences in innovation for both upstream and downstream co-operation. Concurrently, we assess the *breadth* of the relationships by exploring the impacts of the number of co-operating partners on product and process innovation. Finally, testing for possible over-embeddedness in the up / downstream relationships we explore the concepts of diminishing returns in the innovation process. The latter adds to the literature on over-embeddedness in networks where in some cases investments in R&D beyond a certain level lead to negative effects on innovation as strength of connectedness amplifies the effect of diminishing returns from R&D investments on innovation (e.g. Molina-Morales and Exposito-Langa, 2012; Gebreeyesus and Mohnen, 2013; Tomlinson and Fai, 2016).

This paper follows the following structure: first we present the theoretical foundations and links between co-operation and innovation. Second, we focus on the research methodology and conduct analysis of the results. We then discuss our findings in the context of literature contribution and implications from managerial and policy perspective. Finally, we note research limitations and point towards further areas of research.

## 4.2. Conceptual Issues

### 4.2.1. Background on Polish and Czech SME sector

After the World War II, in both Poland and Czech Republic the communist governments were installed. Especially for Poland, the decisions of Yalta Conference in 1945 to leave Poland under the Soviet influence has been seen as disloyalty by their wartime allies. Similarly, the Czech Republic remained under the sphere of communist influence for the next five decades. Soon after the World War II, the newly installed communist governments started the economic re-organisation focused around central planning.

Clearly, the fifty years of centrally planned economies had an impact on how firms operate and innovate in both markets. Between 1945-1990, private ownership and entrepreneurship was banned. The emergence of private commerce in Poland and Czech Republic is relatively new and SMEs often lack the experiences or history of market-led principles of

entrepreneurship and collaboration. For instance, McMillan and Woodruff (2002) in their study on entrepreneurship in Poland, China, Russia and Vietnam highlighted the significant role of entrepreneurs, especially their contribution in setting rules of engagement, collaboration and business activity in environments where market institutions are imperfect. For managers educated and trained in the centrally planned economies, it has been easy to omit the importance of the entrepreneurship, thus their success relied on the ability to build capabilities to sustain in the absence of market institutions, courts enforcing contracts and in times of market volatilities and soaring inflation (McMillan and Woodruff, 2002). However, as Fagerberg and Srholec (2008) noted entrepreneurs' capabilities and well-functioning governance are not built over night and require policy makers to implement incremental improvements to the market's innovation systems to continuously enhance the governance, political environment and openness for investments. Whilst market driven improvements to innovation systems are performed, social aspects such as trust remain important in Polish context (Ioppolo et al., 2016). Similarly, in Czech Republic Vlckova (2011) note the low willingness of Czech managers to share information or knowledge when they co-operate with other firms along the supply chain. This limited confidence and restricted mutual trust may represent factors that reduce the efficiencies of supply chain innovation in both CEE markets and are important factors to consider when analysing the results in this study.

According to the 2016/2017 Annual Report on European SMEs (European Commission, 2017) SMEs in the EU-28 countries employed c93m people representing c67% of total workforce and amounting to c99.8% of all enterprises in the EU-28. In 2016, Polish and Czech SMEs increased employment by 2% and 1% respectively, as compared to average of 1.6% for EU-28 in the same time horizon (European Commission, 2017). Overall, in Poland and Czech Republic SMEs account for 99.8% of 'all non-financial business economy' (European Commission, *Small Business Act Factsheet*, 2017).

### 4.2.2. Innovation in the context of inter-firm's collaborative activities

The way in which firms innovate has evolved over time towards a greater reliance on leveraging the supply chain rather than predominantly focusing on isolated intra-firm activities (von Hippel, 1986; Schiele, 2006; Ageron et al., 2013). As a result, innovation is generated more frequently within the ''network of actors'' in which different players interact with each other in the context of innovative collaborative networks (e.g. Bidault et al., 1998; Chesbrough, 2003; Schiele, 2006; Narasimhan and Narayanan, 2013). Within this network,

Hoegl and Wagner (2005) note a positive impact of downstream-upstream collaboration on product quality which then contributes towards the number of project related benefits (e.g. product development cost impacts, development schedules, etc.). Firms increasingly look outside their boundaries in the search for knowledge, talent and sources of innovation, focusing on firm's internal competences to manage the supply chain and to improve company competitiveness (Inauen and Schenker-Wicki, 2012; Roldán Bravo et al., 2016).

Gradually, as firms become more specialised the need to engage deeper within the supply chain is essential to align internal innovation endeavours together with R&D activities (Narasimhan and Narayanan, 2013). Thus, the firm's engagement into innovative supply chain mechanisms supports the focal firm in the search for new solutions to overcome challenges like costs, quality or lead time (Ageron et al., 2013). Both search and effective adoption of knowledge within the supply chain is increasingly important as firms look to enhance their competitive performance and open up for new opportunities and more innovation (Inauen and Schenker-Wicki, 2012; Narasimhan and Narayanan, 2013). As the boundaries between a firm and its surrounding environment become more open, in a process known as *open innovation*, firms increasingly move away from pure internal R&D focus towards external sourcing of knowledge or ideas which can be commercialised within the firm (Chesbrough, 2003; Inauen and Schenker-Wicki, 2012).

The participation in co-operative ventures (either upstream or downstream) requires the participating firm to develop an *absorptive capacity* which supports the firm in assimilation and usage of knowledge that is acquired from the partnership (Cohen and Levinthal, 1990). In addition, the inclusion of external partners requires focal firm to strengthen internal control mechanisms. For instance, Bahemia (et al., 2017) recognises the importance of patent protection as an important condition for inclusion of broad set of external partners in the innovation process for new product development. This is to prevent any opportunistic behaviours among involved external actors and to safeguard the innovative knowledge that is being created (Bahemia et al., 2017). Dyer and Singh (1998) sets further requirements by suggesting benefits from collaboration are possible when firms exercise effective governance framework in which transaction costs are reduced due to synergies creating substantial advantages as compared to competition.

### 4.2.3. SME Supply chain innovation in Poland and Czech Republic

Lee et al. (2011) in their study on South Korea's healthcare industry find that organisational performance is positively related to the construct of supply chain innovations such as supplier co-operation, supply chain efficiency and quality management in organisational processes. Arlbjørn et al. (2011) also note that firms should organise themselves around improvements in business processes, buyer / supplier network structures and technological innovations to develop and sustain competitive market position. Embedding into collaborative networks, allows firms to benefit from partners' innovative practices by integrating the innovative potential of supply chain actors (Arlbjørn and Paulraj, 2013). In the context of CEE economies and exploring Croatian SMEs, Radas and Božić (2009) noted similarities between developed and transition economies and highlighted the importance of having external links with co-operative partners as one of the factors positively impacting innovation. Golebiowski and Lewandowska (2015) argue that knowledge transfers in CEE economies happens predominantly from developed markets to the CEE markets, rather than via collaboration of CEE firms within their home markets. This may relate to the fact that although Polish market is attractive for foreign firms due to research and intellectual potential, the R&D facilities of foreign-owned companies mainly stay abroad while Polish firms subcontract or act as suppliers within this value chain (Kasperkiewicz and Dworak, 2009). However, as Klonowski (2012) noted in his study on Polish SMEs, the innovation capabilities of Polish SMEs are evolving, and greater efforts will be placed on enhancing internal R&D competences to intensify innovative efforts. This is where our study will add further insight as we explore the breadth and depth of collaboration activities on innovation both in upstream and downstream supply chain relationships.

Turning to Polish firms, Swiadek and Szopik-Depczynska (2014), in their study of firms from Lesser Poland region, highlight the importance of vertical co-operation and highly integrated supply chain networks to enable innovations and support the knowledge transfer within the industrial clusters. In addition, the innovative outputs seem to be positively impacted by the growing intensity and diversity of supply chain relations, suggesting the broader the network and deeper the relationships the greater the innovative outputs of a focal firm (Swiadek and Szopik-Depczynska, 2014). In terms of upstream collaborations, Majewska and Truskolaski (2013) using the data for Polish firms in the 2008 Community Innovation Survey, argue that technical collaborations positively impact firm's innovativeness in Poland. However, Mitrega and Zolkiewski (2012) observed a dark side to

deep supplier relationships in Poland, noting that these may be burdened by opportunity cost of not embarking into alternative potentially beneficial collaborations. In the Polish context, suppliers frequently benefit from a dominant position limiting switching opportunities or production capabilities (Mitrega and Katrichis, 2010). In a product specific context remaining in a deep dyadic upstream relationship may create critical dependencies in the production process, reduce buyer's negotiation power against one dominant supplier or limit the partner's ability to exit the relationship (Mitrega and Zolkiewski, 2012). For Polish firms, the depth of upstream relationships needs to be considered in light of social aspects, such as trust, which has been identified as a factor that may hinder the ability for Polish firms to embrace collaboration in supply chain networks (Ioppolo et al., 2016) or reduce the benefits of co-operative performance (Michalski et al., 2013). In the downstream relationships, Mitrega (2012) in the study on Polish firms, points out the importance of gathering knowledge about customers and creating strong dyadic relationships which will support the product innovations more tailored to customer's needs. For instance, in the product innovations, analysing the Polish SMEs, Zastempowski and Przybylska (2016), noted a significant (55%) increase in the likelihood of large-scale innovations if firms frequently co-operate with customers. This is in line with observations of Gallego et al. (2013) arguing that openness to the external environments and ability to acquire external and new knowledge is related with firm's ability to co-operate and increases its innovative potential.

In the context of Czech Republic, Hájek et al. (2011) note the importance of regional networks and clusters in stimulating the innovative capabilities of Czech firms. This is in line with Stejskal et al. (2016) who, in the study on Czech machinery industry, observed the important role of co-operation between firms to support innovations, highlighting the need for governmental actions to support firm's networking activities. In addition, Srholec (2014) note the importance of attributes such as *'training, quality control and use information technologies'* (Srholec, 2014, p. 149) that are frequently unobserved in surveys, however in Czech context, represent important capabilities influencing innovation of Czech firms. Srholec (2014) argue that firm's ability to build domestic collaborative arrangements is what influences most firm's innovative output. However, McLarty et al. (2012), in their study of Czech SMEs, note that majority of Czech SMEs do not form integrated partnerships within their supply chains. In downstream collaborations, Ehrenberger et al. (2015) observed, based on a large-scale survey of Czech SMEs, that cooperation with customers has a significant and positive influence on product innovation. As customers request more demanding and

usually complex improvements to their products, firms are inspired to greater innovations to meet more demanding customer needs (Ehrenberger et al., 2015). However, in upstream collaboration activities, Urbancová (2013) in her survey on Czech firms, observed that cooperation with suppliers was named by Czech respondents as second most common impulse (c.80% of respondents) for innovation and just after customers (c.90% of respondents). While for most Czech firms, similar to Polish, innovation is a long-term process supported by knowledge sharing and effective partnerships in both up and downstream relationships, their degree of importance and relative influence on innovation may vary (Urbancová, 2013).

The above discussion leaves us with two main research gaps which we will address in this study. First, we note limited literature attention to the concepts of breadth and depth of collaboration and their effects on innovation in Poland and Czech Republic. As discussed above, the existing literature provides for some insight into the upstream and downstream co-operation in both CEE economies, however we will enhance it by exploring effects of SME's embedding into deep and broad relationships. Second, existing literature on both CEE economies, do not provide for analysis of over-embeddedness in supply chain relationships and its impact on innovation. Therefore, the aim of this study is to contribute to the literature by exploring effects of over-engaging in up and downstream in both depth and breadth of relationships. These findings will add to the understanding of Polish and Czech SMEs and will provide base for future studies in breadth and depth of supply chain relationships in both markets.

### 4.2.4. Innovation within conditions of the intensity of upstream (supply) and downstream (buyer) co-operation

The intensity of ties is related to the depth of relationship among co-operative partners characterised by the level of engagement (Laursen and Salter, 2006; Keupp and Gassmann, 2009). The intensity and the multi-dimensional cooperation via enhancing knowledge transfer or organisational learning can significantly contribute to the improved innovative capability of SMEs (Tomlinson and Fai, 2013). The value networks can also contribute to the innovative capabilities of SMEs especially if knowledge, transactional capabilities and willingness to respond to market opportunities is in place (Laakso et al., 2012).

In a new product development, a strong *(intense)* relationship within upstream (supplier) co-operation promotes a better product development performance as a smaller number of suppliers can engage more deeply within the product development cycle (Bidault et al., 1998). Chung and Kim (2003) argue that early engagement of suppliers supports focal firm's innovation capabilities as suppliers strive to improve their innovative capabilities to respond to the new product development. Salvador and Villena (2013) note that benefits from supplier's involvement in the new product development can be enhanced if buyers focus on developing modular products to overcome challenges associated with supplier integration as product, process and supply chain decisions may be subject to managerial trade-offs. Integration challenges could also be addressed when a network of long-term, trusted suppliers is created that provide foundations for suppliers becoming an integral part of new product development, hence contributing to technical and managerial innovation (Bonaccorsi and Lipparini, 1994). Information sharing, frequent communication or early engagement of suppliers in problem resolution positively supports the product design quality (e.g. Takeishi, 2001, Petersen et al., 2005). Thus, the efficient co-operation requires changes in which a firm operates putting more distinct efforts on factors such as proximity of suppliers and their selection, stability of relationship within supply chain or established framework for joint learning that will support innovation (Bonaccorsi and Lipparini, 1994; Narasimhan and Narayanan, 2013).

However, firms should be alert to risks of over-reliance when embedding into supplier partnerships. Firms should focus on ensuring their internal capabilities (e.g. problem solving, internal co-ordination, etc.) are well developed and carefully observe the degree of reliance on external suppliers which may impact firm's competitive advantages against firms who share similar set of suppliers (Takeishi, 2001).

In downstream relationships, the importance of early engagement of buyers within the product development has attracted strong research attention (e.g. Bonner, 2005; He et al., 2014) and often requires development of trusted relationships (He et al., 2014). Although firms focus more frequently on integrating customers within their product development activities, it is increasingly important to create a customer-oriented service to meet complex customer demands and gain their trust (He et al., 2014). It is also relevant to emphasise the importance of team objectives and team's financial rewards once buyers / customers are integrated within the supply chain (Bonner, 2005). If project team's compensation is dependent on generating valuable products to customers, it is then more likely for the team

to engage customers during the product development phase to meet their requirements (Bonner, 2005). Engagement with both suppliers and customers creates foundations for continuous incremental product and process improvements but requires shared benefits and goals to achieve the objectives (Soosay, et al., 2008). Freel and Harrison (2006) recognise the benefits from customer involvement across three main fields: complementarity of resources available with end users, ability to better assess price / performance of a product and benefits from 'demonstration' effects that attracts other customers to the product. This aligns to Tether (2002) observations that co-operation with customers reduces the risks associated with bringing new products to the market and raises probability that other buyers will accept the innovation. In some cases, such co-operative arrangements may support more complex or radical innovations when involved customers are well recognised within the user's community (Tether, 2002; Tomlinson, 2011; Tomlinson and Fai, 2013, 2016). This aligns to findings of Fredberg and Piller (2011) who note that intensive ties with customers help to facilitate radical innovations in situations when customers not only respond to company activities but also actively participate in idea generation.

However, intense ties may also restrict firms from making radical decisions to their products as firms may be willing to explore markets they truly understand when searching for new business partners rather than expand into unknown territories (Henderson, 2006). When firms decide to rely more on customer insights from strong ties, creation of short term ideas focused on firm's current needs may prevail over exploring long term innovative opportunities (Fredberg and Piller, 2011).

Considering above discussion, we formulate following hypotheses:

> **H1**: Firm's innovative output is positively related to the intensity of upstream and downstream co-operation

### 4.2.5. Innovation within the context of breadth of upstream and downstream co-operation

The breadth of ties refers to the number of co-operative partners involved in the innovation process (Laursen and Salter, 2006). Ahuja (2000) argues that the quantity of direct co-operative ties has a positive impact on innovation due to knowledge sharing, complementarity and scale of relationships. Laursen and Salter (2006) suggest firms that embark on search activities for new co-operating partners tend to be more innovative. Becker

and Dietz (2004) note that access to a mix of heterogenous partners supports the access to novel information and strengthens the probability of new product development. The greater the importance of external knowledge from competitors or buyers to a focal firm, the more likely is that growing breadth of ties leads to a greater innovative output (Becker and Dietz, 2004). As the complexity of products increases together with the demands for more specialised knowledge, the breadth of ties becomes increasingly important for SMEs to meet customer's demands, support the financial performance or ability to compete on the market (van de Vrande et al., 2009). Furthermore, Nieto and Santamaria (2007) note that with the growing breadth of co-operative ties a focal firm can also exchange knowledge and fill the resource and skill shortages with the collaborating partner. Similarly, Leiponen and Helfat (2010) find that firms benefit from having a broad access to various knowledge sources which positively impacts successful innovations.

However, Zeng et al. (2010) note differences in which external collaboration impacts innovation suggesting vertical ties (e.g. with customers, suppliers, competition) to have a greater influence than collaboration with research institutions, universities (i.e. horizontal collaboration). Communication issues in horizontal partnerships or intermediary's service quality may impact the quality of innovation as objectives of collaborating partners do not necessarily align to those of SME's (Zeng et al., 2010). Similarly, Schøtt and Jensen (2016) point into the direction of moderating impacts of institutional support to promote innovation. With the presences of institutional support, firms may enhance the quality of their collaborations for both product and process innovations, however the quantity (i.e. *breadth*) of the co-operative network is less to be affected (Schøtt and Jensen, 2016). This could be explained by varying internal and external factors impacting firm's ability to generate successful innovations (Schøtt and Jensen, 2016).

At the organisational level, the large number of ties may also lead to these ties to be weak (Kowlaser and Barnard, 2016). However, Wang (2016) notes that weak ties promote knowledge novelty as they transfer non-redundant information often not available in highly connected networks bound by long lasting and established relationships. Un and Asakawa (2015) argue that firms generate more successful product innovations when they have easy access to the knowledge. In the upstream relationships a narrower knowledge exchange with few suppliers promotes innovation as it is focused on specialised information available with limited suppliers (Un and Asakawa, 2015).

In line with the probabilistic theories, with the growing breadth of partners, firms increase their chances to form partnerships that are more likely to generate successful innovations (Leiponen and Helfat, 2010; Egbetokun, 2015). Huikkola et al. (2013) point towards relational structures in which partners exchange information, learn jointly and enhance knowledge sharing to avoid repeated errors but also to increase shared understanding towards the innovative ideas.

In downstream collaborations focused on new product development, customers or ''lead users'' are important resources for innovative firms, providing ideas and validating hypothesis (von Hippel, 1986). However, as the breadth of co-operating ties decreases firms become increasingly more exposed to dependencies on key supply chain partners (Oke et al., 2013). A greater dependency leads firms to adjust their innovation strategies to either enhance internal product development capabilities or assess the right breadth of supply chain partnerships to minimise risks of dependencies (Oke et al., 2013).

Considering above discussion, we formulate following hypotheses:

> **H2**: Firm's innovative output is positively related to the breadth of upstream and downstream co-operation

### 4.2.6. Relational embeddedness and firm's innovation

For SMEs, the scarcity of resources, relative constraints in accessing knowledge or ability to commercialise new products creates an environment in which SMEs are more inclined to embed into co-operative networks (van de Vrande et al. 2009). However, as SMEs are resource constrained these networks need to be effective and lead to innovations directly impacting firm's performance (Verreynne et al., 2012). Embedding into networks allows SMEs to overcome size challenges, allowing them to access knowledge or resources internally not available (Verreynne et al., 2012). Becker and Dietz (2004) note that collaboration with a diverse set of partners not only raises the chances for a successful product innovation but also allows for partners to complement to the firm's innovative capabilities. Hagedoorn (1993) argues that collaborative activities between partners reduce risks associated with innovations due to risk-sharing effects.

However, in some instances over-cooperation may not provide improved innovative outputs or even lead to diminishing returns (e.g. Tomlinson and Fai, 2016). For instance, Love et al. (2014) note there are limits to the benefits from external linkages on innovation, mainly as

firms must cope with extensive networks and extract value from these partnerships, hence require cognitive abilities to work with even growing number of partners. Leiponen and Helfat (2010) observe diminishing returns in innovation with the growing number of knowledge sources. Laursen and Salter (2006) suggest there is an optimal level of openness (both breadth and depth) beyond which the innovative output decreases.

#### 4.2.6.1. Over-embeddedness in the depth of upstream / downstream collaboration and firm's innovation

In the context of co-operation strength (intensity), Gebreeyesus and Mohnen (2013) argue that too intense reliance on network clusters may lead to a 'lock in' effect which may be detrimental to innovative activities. Similarly, Wang (2016) found an inverted U-shape relationship between the tie strength and cognitive knowledge suggesting that increasing strength of a tie increases knowledge creation, however post certain threshold it impedes its diversity. With a ''healthy mix'' of weak and strong ties a firm may generate more successful innovations as it creates and exchanges more knowledge which is both new and diverse (Wang, 2016). Hottenrott and Lopes-Bento (2016) argue that intensive collaboration has decreasing or even negative returns as post certain threshold firms need to pay greater attention to monitoring, coordination and mitigation of risks related to potential opportunistic activities by the cooperating partners. For resource constrained SMEs, Hottenrott and Lopes-Bento (2016) observe a greater tolerance for intensive collaborations, however firms tend to exceed the optimal level of intensity as they search for innovations.

In some instances, intensive collaborative relationships characterised by growing social capital (e.g. trust) factors exhibit positive effects on innovation, however at certain point become negative (Molina-Morales and Martinez-Fernandez, 2009). The reasons for it could relate to over-embeddedness in existing relationship that may prevent from the search for novel knowledge, especially for firms in clusters with a close proximity between partners (Molina-Morales and Martinez-Fernandez, 2009). In an intense upstream relationships, Tomlinson and Fai (2016) noted a non-linear relationship in new product innovations, suggesting firms may over-engage in supplier relationships or become ''locked'' in existing technologies which prevents them from innovative experimentation. While, frequent and intensive interactions between partners require investments in time and resources (Molina-Morales and Martinez-Fernandez, 2009), SMEs from CEE economies conscious of limited

resources may prefer to embed in fewer but stronger relationships, hence could be vulnerable to potential diminishing returns in innovation.

Considering above discussion, we formulate following hypothesis:

**H3**: Firms that over-cooperate with other partner firms are less innovative

#### 4.2.6.2. Over-embeddedness in the breadth of upstream / downstream collaboration and firm's innovation

Turning into co-operation breath, Hoecht and Trott (2006) argue that exclusive co-operative agreements with single or very few partners may be hindering firm's innovative potential as opportunity costs for locking up information exchange between various partners could be too high as compared with benefits achieved from exclusive co-operative arrangements. In addition, firms internally focused or co-operating with fewer partners may missed out on important opportunities that remain outside of their current co-operative networks (Chesbrough, 2003).

However, with growing breadth of collaborative partners, the complexities of co-ordination increase (Zanfei, 2000), especially for SMEs that are often constrained in terms of human resources and financial capabilities (e.g. Hyytinen and Toivanen, 2005; Deffains-Crapsky and Sudolska, 2014). In addition, the greater the breadth of co-operative partners, the more significant becomes the SME's ability to extract the contextual and relevant knowledge from these relationships to focus on know-how that supports its comparative advantage and innovative activities (Zanfei, 2000). This ability becomes crucial to the success of innovative endeavours, as firms mostly engage in strategic research-oriented co-operative agreements or focus their collaborative activities to reduce operating costs of a market access (Hagedoorn and Schakenraad 1994).

Furthermore, Enkel (et al., 2009) argue that significant number of co-operating partners may lead to situations when firms lose control over their core competences as the number of partners increase. Therefore, a balance between too high or too low number of collaborating partners is crucial to support innovating activities together with the ability to sustain the development of firm's core competences and optimised time to market for a successful product (Enkel et al., 2009). This aligns with Huggins and Thompson (2015) who suggest that innovative firms should 'balance the portfolio of networks' to ensure access to the highest quality of knowledge while at the same time optimising their management

capabilities to effectively search and absorb the information to stimulate innovative activities. However, if balance is not achieved and firms engage in ‘’over-search’’ in terms of breadth of co-operative activities, Laursen and Salter (2006) observed there is a tipping point post which innovative performance is hampered. As innovation search is associated with costs, time and management attention, Laursen and Salter (2006) find that firms benefit from the breadth of co-operation, however need to be mindful of costs and incremental benefits for each of the collaborative interactions.

Considering above discussion, we formulate below hypothesis:

**H4:** Co-operation with too many partners leads to less innovation

## 4.3. Research Methodology

### 4.3.1. Sample

In 2015 email surveys have been sent to Polish and Czech SMEs across four sectors: manufacturing, trade, services and construction. The total sampling frame of 2907 Polish and Czech SMEs was created by a specialised research agency[22] in a controlled manner in line with recommendations for online surveys using third-party data base providers (Furrer and Sudharshan, 2001; Evans and Mathur, 2005). To select the sampling frame, we drew representative random samples from four main industries (manufacturing, trade, services, construction) used by Central Statistical Office of Poland[23] as reference. The sample’s representativeness was analysed by comparing the sampling frame with the distribution of SME population used by Central Statistical Office of Poland. This analysis revealed no significant differences between sampling frame and the target population. In total, 321 valid responses received (11% response rate); this represented a sampling error of 5.2% at the 95% confidence interval, which is within acceptable limits for survey research (Oerlemans *et al.*, 2006). The analysis of variance (ANOVA) between Polish and Czech data revealed no significant differences (see Appendix B).

Finally, to reduce the possibility of common method bias, some items in the questionnaire have been reversed. The anonymity of respondents has also been assured to enable truthful

[22] ABM Media (http://www.abmmedia.com.pl/)
[23] http://stat.gov.pl/en/

responses. In addition, The Harman's single-factor test was performed in which all variables were loaded into the factor analysis where the largest factor accounted for 11.8% of variance explained. In summary, a common method bias is not a major concern in this study (Podsakoff *et al.,*2003).

### 4.3.2. Questionnaire and variable construction

The questionnaire used in this research is based on the practice of previous studies (see Appendix C). Firms were asked about their company data, research and development activities, source of financing and co-operative ties over the past five years. Most questions are based on the 7-point Likert scale. The primary variables of interest are described below:

***Innovation (both product and process)***

Previous studies often used categorical measures to capture innovative output, for instance distinguishing between radical (i.e. new) or incremental (i.e. improvements) for product or process innovations (e.g. De Propris, 2002). However, these types of innovation measures may often be misinterpreted by survey respondents as reliability of these measures are usually context dependent and rely on subjective assessments (Katila, 2000). This research follows Molina-Morales and Martinez-Fernandez (2006, 2009) and Tomlinson and Fai (2016) where respondents were asked questions on the number of new products introduced, alterations to existing products and changes to the production process over the period of last five years. These are frequency-based measures and in line with Tomlinson and Fai (2016) questions asked in the survey aimed to cover for widest possible sphere of innovative activity rather than purely focusing on patents. The 7-point Likert scale was utilised, and firms were categorised in compliance with the EU guidelines[24]. In addition, mean scores across all the items listed in Appendix C together with the Cronbach's alpha (α) validation statistic have been calculated.

***Buyer Cooperation (over product and process innovation)***

For the intensity of collaboration, firms were asked questions on the degree of their co-operations with the main buyer using 7-point Likert scale in line with earlier studies (Tomlinson and Fai (2016). Buyer co-operation was constructed for both product and process innovation using mean scores for the items listed in Appendix C. For the breadth of

[24] Based upon EU recommendation 2003/361 where staff headcount: (1) Medium-sized companies < 250; Small < 50; Micro < 10; (2) turnover or balance sheet total respectively: Medium-sized ≤ EUR 50m or EUR 43m; Small EUR 10m; Micro EUR 10m

the co-operation, firms were asked to select ranges for the number of cooperating partners based on Gebreeyesus and Mohnen (2013). The ranges are listed in Appendix C.

***Supplier Cooperation (over product and process innovation)***

For the intensity of collaboration, firms were asked questions on the degree of their co-operations with the main supplier using 7-point Likert scale in line with earlier studies (Tomlinson and Fai (2016). Supplier co-operation was constructed for both product and process innovation using mean scores across the items listed in Appendix C. For the breadth of the co-operation, firms were asked to select ranges for the number of cooperating partners based on Gebreeyesus and Mohnen (2013). The ranges are listed in Appendix C.

***Control Variables***

To account for differences between firms, several control variables have been utilised. For instance, company size and spend on R&D activities are based upon Cohen and Levinthal (1990), Molina-Morales and Exposito-Langa (2012) and Yam *et al.* (2011). In addition, we use firm age and main owner share variables based upon Ortega-Argilés *et al.* (2005) and Laforet (2013. Finally, we control for country differences using country dummy variable, with Czech Republic being designated as the base.

### 4.3.3. Descriptive Statistics

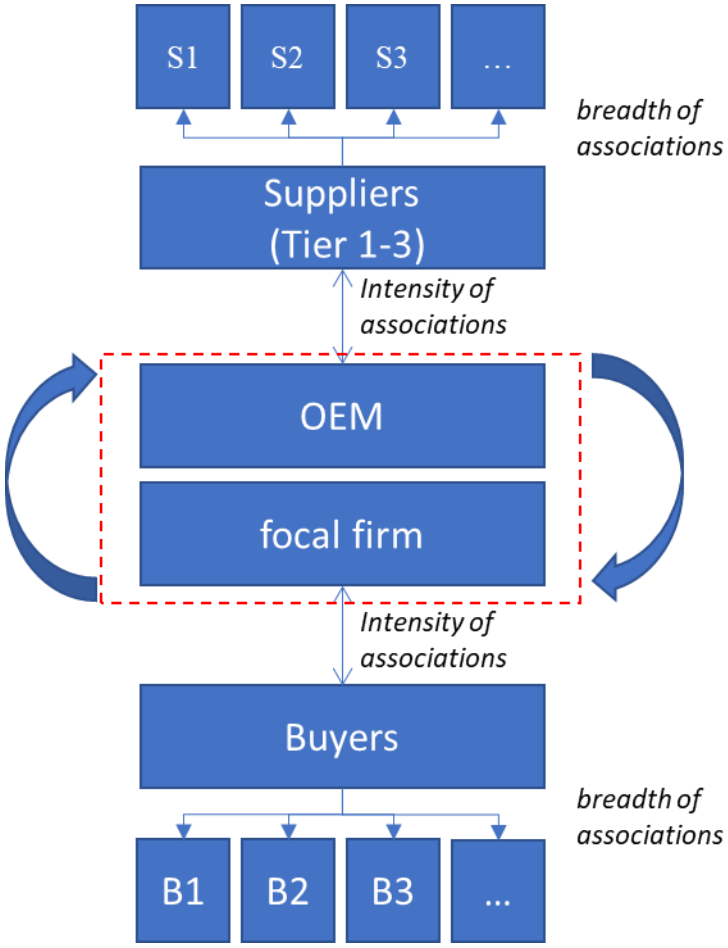
The Appendix D provides details of the descriptive statistics for all 321 SMEs used in the sample. For each construct, Cronbach's alpha (α) is reported, enabling the assessment whether items in the sample are related or share a proportion of common variance. of 'convergent validity'. A high Cronbach's alpha score indicates that sample of items performs well in capturing the construct which motivated the measure (Churchill, 1979, p. 68). In this study, all constructs showed Cronbach's alpha greater than 0.7 thus satisfying the condition for internal consistency and reliability (Nunnally, 1978; Clark and Watson, 1995; Morera and Stokes, 2016). The assessment of 'face validity', which analyses the theoretical reasoning for using particular scale items, was satisfied by utilising previously used multi-scale items, as discussed above and presented in Appendix C. In addition, the Variance Inflation Factors (VIFs) have been calculated to detect multicollinearity, a case when variance of regression coefficient is inflated because of collinearity (O'Brien, 2007). In summary, all VIFs in this demonstrate values close to 1 indicating that multicollinearity is unlikely an issue in this study (O'Brien, 2007).

### 4.3.4. Contextual representation of the supply chain relationships

This research recognises that relational and business character of commercial engagements between actors along the supply chain may vary dependent on the role each actor plays. Thus, below representation will help depict certain associations that are represented in the research. As the survey was sent to SMEs belonging to various industrial categorisations, we recognise that these firms may act as OEMs (*Original Equipment Manufacturer*), buyers or suppliers dependent on different business engagement. Hence, for the focal firm, a "buyer" could represent an ultimate end-customer but also a retailer as almost 50% of firms in our survey belong to either production, construction or retail industrial category. Thus, a focal firm could sell directly to customers (B2C) or to other business (B2B). Furthermore, both buyers and suppliers could act as OEMs to larger OEMs in the supply chain as well. In terms of suppliers, we recognise that suppliers for a focal firm may be categorised as Tier 1, Tier 2 or Tier 3 suppliers depending on their position on the supply side towards the OEM. However, in our research we do not distinguish between different tiers of suppliers but recognise that their roles may interchange given that c46% of our firms belong to a micro segment. This segment is often categorised by a high degree of trust between a micro firm and its supplier as micro firms are resource constrained, dependent on owner / manager expertise and thus commitment to maintain a relationship between a micro firm and its supplier is key (McDowell et al., 2009; Redondo and Fierro, 2007).

In addition, given that almost half of the data consists of micro firms, the activities they perform within a supply chain could vary. For instance, micro firms in our study could be either acting as OEM, suppliers or buyers. However, they may also act as OEM or sell their products to a different OEM. Thus, the role of a micro firm in a supply chain may be fluid and frequently overlapping. For instance, micro firms could also act as sub-contractors to OEMs, have their own suppliers and own buyers (which may be OEMs as well). Therefore, it is not certain that a focal firm in our data sample acts as an OEM in all circumstances. With that in mind, a below middle section of the graph (i.e. circled in red) represents the varying roles a firm can play in the supply chain.

**Figure 2 Depth and breadth of supply chain associations**




In terms of breadth of supplier associations, Porter (1997) notes that a more centralised approach (e.g. reduced number to few core suppliers) can in certain cases be preferable. For instance, it allows for a strong integration of suppliers into the OEM production process but also enhances co-operation between few suppliers so that competition between them is transformed into a new idea generation collaboration which may support innovation (Porter, 1997). Recognising that not all supplier relationships are of equal importance, a focal firm requires to assess what relationship it should have with key suppliers (either weak or intense) or whether to embrace a longer- or short-term collaboration (Manuj and Sahin, 2011).

In the subsequent sections, we present regression models used in the research and provide a discussion of results in the context of intensity and breadth of associations. In addition, we focus on relational embeddedness between a focal firm and its suppliers or buyers.

### 4.3.5. Regression models and specification

This study explores effects of supply chain collaboration on innovation. Specifically, we explore the *depth* of the association and the *breadth* of the relationships by analysing the impacts related to the intensity and the number of co-operating partners on product and process innovation respectively. We also differentiate between upstream and downstream co-operation to add further enhancement to the analysis. The study employs regression analysis based on the standard production functions supported by control variables (i.e. spend on R&D, company size, main owner share, firm age). The country dummy variable was introduced with Czech Republic as the base. The analytical software IBM SPSS Statistics v.22 has been used to perform all calculations.

To explore the depth of the relationship upon innovation, we introduce a quadratic transformation of Buyer / Supplier Co-operation constructs. Similarly, quadratic functions have been used to assess the breadth of the relationships for Number of Buyers / Suppliers variables. The estimating equations are as follows:

Depth of association:

**(4) Product Innovation** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Buyer Co-operation + $\beta 7$ Supplier Co-operation + $\beta 8$ Buyer Co-operation (squared) + $\beta 9$ Supplier Co-operation (squared) + $\varepsilon i$

**(5) Process Innovation** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Buyer Co-operation + $\beta 7$ Supplier Co-operation + $\beta 8$ Buyer Co-operation (squared) + $\beta 9$ Supplier Co-operation (squared) + $\varepsilon i$

Breadth of association:

**(1) Product Innovation** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Number of Buyers + $\beta 7$ Number of Suppliers + $\beta 8$ Number of Buyers (squared) + $\beta 9$ Number of Suppliers (squared) + $\varepsilon i$

**(2) Process Innovation** = $\beta 0$ + $\beta 1$ Spend on R&D + $\beta 2$ Company Size + $\beta 3$ Main owner share + $\beta 4$ Firm Age + $\beta 5$ Country Dummy + $\beta 6$ Number of Buyers + $\beta 7$ Number

of Suppliers + $\beta 8$ Number of Buyers (squared) + $\beta 9$ Number of Suppliers (squared) + $\varepsilon i$

## 4.4. Results

### 4.4.1. Regression analysis

All models are well specified (see table below) and *R-squared* statistics are in line with multivariate regression results in innovation studies. The analysis confirmed evidence for linear relationship for buyer / supplier co-operation for both product and process innovation and number of suppliers on product and process innovation. The evidence of curvilinear relationship has been confirmed for buyer co-operation on product innovation.

In all models, spend on R&D remain significant and has a positive impact on both product and process innovation. In addition, company size demonstrated varying levels of significance across the models. Remaining two control variables (i.e. main owner share and firm age) have not shown significant influence across the analysed models.

In addition, following the techniques outlined by Aiken and West (1991), below columns 4 and 5 in all results tables demonstrate outcomes of estimations using the interaction terms between country dummy and number of buyers, number of suppliers, number of buyers (squared), number of suppliers (squared), buyer co-operation, supplier co-operation, buyer co-operation (squared), supplier co-operation (squared) across product and process innovation measures. The reported results are relative to Czech Republic (which acts as a base) and except for buyer & supplier co-operation (incl. squared variables) over product innovation, all other models demonstrate slightly lower adjusted R-squared values as compared with models without inclusion of multiplicative dummies.

The summary of multivariate regression results, curvilinear relationship and interaction terms are presented in the sections below.

## 4.4.2. Process Innovation

### 4.4.2.1. Depth of relationship

The depth (intensity) of relationship has been measured by regressing buyer / supplier co-operation on process innovation. In model 3 we add quadratic terms for buyer and supplier co-operation and models 4 and 5 include the interaction terms between Polish firms and buyer / supplier co-operation. Below table provides a summary of results:

**Table 6. Buyer / Supplier Co-operation on Process Innovation**

| | dependent variable (process innovation) | | | | |
|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 |
| β0 | 2.226 (0.445)*** | -0.021 (0.525) | -0.825 (1.164) | -1.089 (1.500) | -0.197 (4.072) |
| Spend on R&D | 0.388 (0.061)*** | 0.332 (0.056)*** | 0.325 (0.057)*** | 0.327 (0.057)*** | 0.325 (0.058)*** |
| Company Size | 0.250 (0.075)*** | 0.210 (0.069)*** | 0.209 (0.071)*** | 0.216 (0.071)*** | 0.216 (0.072)*** |
| Main owner share | 0.042 (0.051) | 0.037 (0.047) | 0.034 (0.047) | 0.037 (0.047) | 0.038 (0.048) |
| Firm Age | -0.001 (0.005) | 0.000 (0.005) | 0 (0.005) | 0.000 (0.005) | 0.000 (0.005) |
| Polish Firms | -0.358 (0.277) | -0.479 (0.256)* | -0.467 (0.257)* | -0.083 (1.193) | -1.023 (4.236) |
| Czech Firms | | | | | |
| Buyer Co-operation | | 0.263 (0.063)*** | 0.112 (0.273) | 0.388 (0.349) | 0.799 (0.954) |
| Supplier Co-operation | | 0.305 (0.086)*** | 0.769 (0.484) | 0.584 (0.561) | -0.131 (1.951) |
| Buyer Co-operation (squared) | | | 0.02 (0.034) | 0.018 (0.034) | -0.035 (0.118) |
| Supplier Co-operation (squared) | | | -0.048 (0.049) | -0.044 (0.049) | 0.033 (0.205) |
| Polish Firms * Buyer Co-operation | | | | -0.289 (0.231) | -0.734 (0.995) |
| Polish Firms * Supplier Co-operation | | | | 0.152 (0.331) | 0.912 (2.009) |
| Polish Firms * Buyer Co-operation (squared) | | | | | 0.057 (0.123) |
| Polish Firms * Supplier Co-operation (squared) | | | | | -0.082 (0.211) |
| Adjusted R-squared | 0.132 | 0.273 | 0.270 | 0.270 | 0.266 |
| F statistic | 10.541*** | 17.875*** | 13.972*** | 11.600*** | 9.779*** |

N = 315

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

In model 2 we observe significant values (at 1% level) for buyer and supplier co-operation providing evidence for linear relationship between both buyer / supplier co-operation and process innovation. We also note the positive signs of the buyer / supplier co-operation variables indicating a positive relationship between buyer / supplier co-operation and process innovation. Second model also provides for the highest adjusted R-squared value among all

analysed models. The introduction of the quadratic terms for both buyer and supplier co-operation in model 3 is not demonstrating significant values across independent variables.

We also note interesting country specific differences in above table. We find significant values (at 10% level) for the country dummy in buyer / supplier co-operation model over process innovation (see Table 1, column 2) suggesting Polish firms demonstrate lower process innovation values than their Czech counterparts.

## 4.4.2.2. Breadth of relationship

The breadth of relationship in process innovation has been measured by regressing the number of buyers / suppliers variables on process innovation (see model 2). In the model 3 we add quadratic terms for number of buyers and number of suppliers and in final models 4 and 5 we include the interaction terms between Polish firms and number of buyers / suppliers. Below table provides a summary of results:

**Table 7. Number of Buyers / Suppliers on Process Innovation**

| | dependent variable (process innovation) | | | | |
|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 |
| β0 | 2.265 (0.452)*** | 1.686 (0.523)*** | 0.494 (0.790) | -0.496 (1.096) | -1.374 (1.933) |
| Spend on R&D | 0.385 (0.061)*** | 0.376 (0.061)*** | 0.372 (0.060)*** | 0.365 (0.061)*** | 0.371 (0.061)*** |
| Company Size | 0.241 (0.076)*** | 0.121 (0.082) | 0.130 (0.082) | 0.118 (0.083) | 0.124 (0.083) |
| Main owner share | 0.037 (0.051) | 0.056 (0.051) | 0.050 (0.051) | 0.048 (0.051) | 0.054 (0.051) |
| Firm Age | 0.000 (0.005) | 0.001 (0.005) | 0.001 (0.005) | 0.002 (0.005) | 0.001 (0.005) |
| Polish Firms | -0.355 (0.285) | -0.391 (0.280) | -0.393 (0.281) | 0.779 (0.955) | 1.814 (2.044) |
| Czech Firms | | | | | |
| Number of Buyers | | 0.012 (0.061) | 0.502 (0.378) | 0.561 (0.393) | 1.649 (1.003) |
| Number of Suppliers | | 0.177 (0.057)*** | 0.482 (0.271)* | 0.654 (0.317)** | 0.222 (0.844) |
| Number of Buyers (squared) | | | -0.061 (0.047) | -0.056 (0.047) | -0.199 (0.129) |
| Number of Suppliers (squared) | | | -0.041 (0.035) | -0.043 (0.035) | 0.013 (0.108) |
| Polish Firms * Number of Buyers | | | | -0.113 (0.171) | -1.377 (1.086) |
| Polish Firms * Number of Suppliers | | | | -0.160 (0.172) | 0.329 (0.893) |
| Polish Firms * Number of Buyers (squared) | | | | | 0.165 (0.139) |
| Polish Firms * Number of Suppliers (squared) | | | | | -0.065 (0.115) |
| Adjusted R-squared | 0.128 | 0.157 | 0.163 | 0.162 | 0.161 |
| F statistic | 10.218*** | 9.346*** | 7.776*** | 6.521*** | 5.621*** |

N = 313

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

While models 2, 3 and 4 provide evidence for a significant positive linear relationship between number of suppliers and process innovation, the model 3 provides for the highest Adjusted R-squared. The variables show significant values at 1%, 10% and 5% levels for models 2, 3 and 4 respectively. None of the squared variables and interaction terms in models 3 and 4 demonstrate significant values suggesting there is no indication for non-linear relationship between the breadth of relationship and process innovation. The interaction terms in models 4 and 5 also do not demonstrate significant values suggesting the breadth of association is not influenced or dependent on country specific factors.

## 4.4.3. Product Innovation

### 4.4.3.1. Depth of relationship

The depth (intensity) of relationship between buyer and supplier co-operation and product innovation has been analysed and results are provided in below table:

**Table 8. Buyer / Supplier Co-operation on Product Innovation**

| | dependent variable (product innovation) | | | | |
|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 |
| β0 | 2.503 (0.496)*** | 0.820 (0.624) | -0.284 (1.370) | 0.987 (1.740) | -7.372 (4.610) |
| Spend on R&D | 0.418 (0.068)*** | 0.379 (0.067)*** | 0.392 (0.067)*** | 0.391 (0.066)*** | 0.370 (0.067)*** |
| Company Size | 0.243 (0.085)*** | 0.216 (0.082)*** | 0.179 (0.083)** | 0.188 (0.083)** | 0.157 (0.084)* |
| Main owner share | -0.017 (0.058) | -0.021 (0.056) | -0.011 (0.055) | 0.000 (0.056) | 0.004 (0.055) |
| Firm Age | 0.001 (0.006) | 0.001 (0.006) | 0.002 (0.006) | 0.001 (0.006) | 0.002 (0.006) |
| Polish Firms | 0.113 (0.308) | 0.040 (0.300) | -0.008 (0.299) | -1.468 (1.353) | 7.578 (4.805) |
| Czech Firms | | | | | |
| Buyer Co-operation | | 0.181 (0.075)** | 0.970 (0.321)*** | 1.457 (0.409)*** | 2.271 (1.066)** |
| Supplier Co-operation | | 0.234 (0.101)** | 0.117 (0.569) | -0.542 (0.655) | 2.504 (2.126) |
| Buyer Co-operation (squared) | | | -0.101 (0.040)** | -0.102 (0.040)** | -0.200 (0.129) |
| Supplier Co-operation (squared) | | | 0.014 (0.057) | 0.015 (0.057) | -0.300 (0.218) |
| Polish Firms * Buyer Co-operation | | | | -0.514 (0.269)* | -1.423 (1.116) |
| Polish Firms * Supplier Co-operation | | | | 0.707 (0.371)* | -2.532 (2.197) |
| Polish Firms * Buyer Co-operation (squared) | | | | | 0.110 (0.136) |
| Polish Firms * Supplier Co-operation (squared) | | | | | 0.335 (0.225) |
| Adjusted R-squared | 0.116 | 0.173 | 0.186 | 0.192 | 0.199 |
| F statistic | 9.331*** | 10.453*** | 9.010*** | 7.818*** | 7.021*** |

N = 316

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

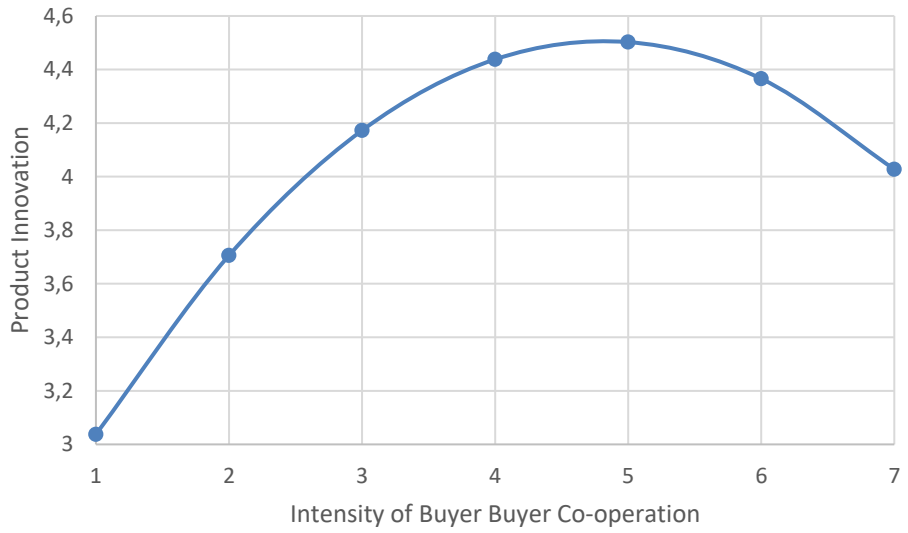
The results from above regression models provide evidence for number of interesting observations. Firstly, the buyer co-operation influence on product innovation demonstrates significant values across all analysed models (at 1% and 5% levels) confirming a linear relationship between the analysed variables. Second, supplier co-operation in model 2 shows significant values (at 5% level) suggesting a linear relationship with product innovation. Interestingly, with the inclusion of further variables in the subsequent models the significance of supplier co-operation cannot be confirmed. These results draw some similarities to earlier discussed results for process innovation, where both supplier and buyer co-operation demonstrated a linear relationship (model 2, Table 1) which couldn't have been confirmed in models which included squared variables.

Finally, there are two areas where we would like to focus with regards to the depth of association between buyer / supplier co-operation and product innovation. First is the evidence of non-linear relationship between buyer co-operation and product innovation and second is the analysis of interaction terms. Below two sections provide more detailed analysis of the results for these two findings.

### 4.4.3.2. Curvilinear relationship of buyer co-operation on product innovation

As presented in above Table 3, the buyer co-operation and product innovation exhibit a non-linear relationship (see column 3 and 4). The negative signs of the co-efficient indicate a curvilinear relationship with variables demonstrating significance at 5% level. We analyse this relationship by depicting the two variables on a below graph illustrating the impacts of how intensity of buyer co-operation influences product innovation:

**Figure 3. Curvilinear relationship for Buyer Co-operation and Product Innovation**




As presented in above graph, with the growing intensity of buyer co-operation, the estimates for product innovation increase. However, post certain threshold, the values of product innovation start to decrease representing diminishing and ultimately negative returns. By taking average values of control variables, rounding them to the nearest absolute figure and multiplying them with the regression model estimates, we estimate the optimal level of buyer co-operation intensity to be 4.81 at which point product innovation is at its maximum level (i.e. construct value of 4.51). While we note that scale used in this survey was perception-based, the coefficient values (e.g. 4.81) may not be easily transferrable or recognised in other studies. However, the evidence of curvilinear relationship between product innovation and buyer co-operation observed in this study is providing a further interesting insight into the dynamic relationship between buyer co-operation and product innovation. Depicting the variables in Figure 1 above allows us for conceptual representation of the curvilinear relationship, where the growing intensity of buyer co-operation beyond certain threshold, leads to the decrease in values of product innovation. In discussion section 5.3 below, we

explore number of potential explanations and discuss a conceptual reasoning as to why such curvilinear relationship may exist.

### 4.4.3.3. Analysis of interaction terms

Following the techniques outlined by Aiken and West (1991), columns 4 and 5 in Table 8, we observe significant values (at 10% level) for two interaction terms: (i) between Polish firms and buyer co-operation, and (ii) between Polish firms and supplier co-operation (see Table 8, column 4). The regression estimates could be interpreted as follows. In average, the country specific influence of Polish firms on the impact of buyer co-operation on product innovation is lower than for the Czech firms. Similarly, in average, the country specific influence of Polish firms on the impact of supplier co-operation on product innovation is higher than for Czech firms. While we treat these results with caution, observed findings are in line with (Woodward et al., 2012) who noted Polish firms are more frequently engaged in supplier innovative collaborations. Downstream engagements are not as frequent as Polish firms focus more on winning and executing contracts what not necessarily translates into enhanced product innovations (Woodward et al., 2012).

The analysis of interaction terms has been conducted for all regression models in this study and none of the interaction terms other than these discussed above show significant values, suggesting that the impact of number of buyers, number of suppliers on both product and process innovation is not influenced or dependent on country specific factors. Similarly, buyer co-operation and supplier co-operation on process innovation is not dependent or influenced by country specific factors. While interaction terms provide interesting mechanism to investigate specific drivers of influences, we interpret the results with caution as inclusion of multiplicative dummies may raise a possibility of multicollinearity, which may affect the levels of individual coefficient significance (Greene, 2008).

## 4.4.3.4. Breadth of relationship

The breadth of relationship is analysed by regressing the number of suppliers / buyers over product innovation. Model 2 provides for the highest Adjuster R-squared values and provides evidence for significant (at 1% level) influence of number of suppliers on product innovation. Below table provides the summary of results:

**Table 9. Number of Buyers / Suppliers on Product Innovation**

| | dependent variable (product innovation) | | | | |
|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 |
| β0 | 2.464 (0.505)*** | 1.637 (0.585)*** | 1.530 (0.891)* | 1.347 (1.240) | 2.062 (2.184) |
| Spend on R&D | 0.416 (0.068)*** | 0.411 (0.068)*** | 0.413 (0.068)*** | 0.412 (0.069)*** | 0.413 (0.069)*** |
| Company Size | 0.238 (0.085)*** | 0.099 (0.092) | 0.101 (0.092) | 0.106 (0.094) | 0.103 (0.094) |
| Main owner share | -0.020 (0.058) | 0.001 (0.057) | 0.003 (0.057) | 0.002 (0.058) | 0.003 (0.058) |
| Firm Age | 0.001 (0.006) | 0.003 (0.006) | 0.003 (0.006) | 0.002 (0.006) | 0.002 (0.006) |
| Polish Firms | 0.173 (0.316) | 0.132 (0.310) | 0.153 (0.314) | 0.401 (1.080) | -0.402 (2.309) |
| Czech Firms | | | | | |
| Number of Buyers | | 0.049 (0.069) | -0.061 (0.426) | 0.001 (0.445) | -0.086 (1.134) |
| Number of Suppliers | | 0.196 (0.064)*** | 0.369 (0.305) | 0.325 (0.358) | -0.048 (0.935) |
| Number of Buyers (squared) | | | 0.014 (0.053) | 0.016 (0.053) | 0.027 (0.146) |
| Number of Suppliers (squared) | | | -0.023 (0.040) | -0.024 (0.040) | 0.025 (0.120) |
| Polish Firms * Number of Buyers | | | | -0.094 (0.193) | 0.004 (1.228) |
| Polish Firms * Number of Suppliers | | | | 0.056 (0.194) | 0.475 (0.991) |
| Polish Firms * Number of Buyers (squared) | | | | | -0.012 (0.157) |
| Polish Firms * Number of Suppliers (squared) | | | | | -0.055 (0.127) |
| Adjusted R-squared | 0.116 | 0.150 | 0.146 | 0.141 | 0.136 |
| F statistic | 9.235*** | 8.943*** | 6.957*** | 5.684*** | 4.798*** |

N = 313

Non-standardised coefficients (errors in brackets); ***p<0,01; **p<0,05; *p<0,1

While we can confirm linear positive relationship between number of suppliers and product innovation, none of the other variables demonstrate significant values. The inclusion of squared variables and multiplicative dummies (models 3, 4 and 5) do not provide evidence for non-linear relationships nor for any country specific interactions.

### 4.4.4. The relationship between firm size and innovation

Although firm size was not a specific focus of this study and the variable *company size* was used as part of control variables, we provide some interesting findings in this section on the influence of company size on innovation. To do so, we have conducted an ANOVA analysis in the Table 5 below to understand whether there are significant differences between various firm sizes and innovation variables. The analysis of ANOVA in the below table reveals significant differences between two firm size groups (i) fewer than 10 employees and (ii) 50-99 employees. Apart from these two groups, no other company size clusters measured by the number of employees had a significantly effect on either product or process innovation constructs.

**Table 10. Company Size ANOVA (combined Polish and Czech sample)**

| **PL&CZ *(N=320)*** | **Firms with fewer than 10 employees *(N=150)*** | | **Firms with employees between 50-99 *(N=42)*** | | **F-test** | **eta (squared)** |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Process Innovation | 3.3736 | 1.65578 | 4.2222 | 1.66042 | 2.723** | 0.049 |
| Product Innovation | 3.8233 | 1.87543 | 4.9167 | 1.61893 | 2.814** | 0.051 |

The condition of equality of variance for two groups has been met and assessed using Levene's test, concluding there are no significant differences in variance within analysed population (Gastwirth *et al*., 2009). In addition, coefficient eta-squared has been calculated as a measure of *effect size*. Eta-squared provides a proportion of total variance that is attributed to an effect and hence provides a popular measure to ascertain the degree of strength (Cohen, 1988; Lakens, 2013). Our findings suggest the effect size (i.e. firm size degree of influence strength on either product or process innovation) falls within small levels (i.e. between 0.01-0.06) according to the benchmarks provided in the literature (e.g. Cohen, 1988; Lakens, 2013). Further to the Bonferroni post hoc analysis conducted in SPSS (see below summary table), the product innovation values are in average by 1.093 lower for a focal firm with fewer than 10 employees as compared with companies employing between 50-99 personnel. In process innovation, firms with less than 10 employees show in average 0.849 smaller values than firms with 50-99 staff levels.

**Table 11. Bonferroni (post hoc analysis) of company size**

| **Dependent variable** | **Company Size** (in number of employees) | | **Mean difference** (standard error in brackets) **(i) - (ii)** |
|---|---|---|---|
| | **(i)** | **(ii)** | |
| Product Innovation | <10 | 10-49 | -0.592 (0.231) |
| | | 50-99 | -1.093 (0.313)** |
| | | 100-149 | -0.784 (0.500) |
| | | 150-199 | -0.427 (0.745) |
| | | 200-250 | -1.510 (1.044) |
| | | >250 | -0.093 (0.745) |
| Process Innovation | <10 | 10-49 | -0.456 (0.208) |
| | | 50-99 | -0.849 (0.281)* |
| | | 100-149 | -1.055 (0.449) |
| | | 150-199 | -0.849 (0.669) |
| | | 200-250 | -1.404 (0.937) |
| | | >250 | -0.015 (0.669) |

***p<0,01; **p<0,05; *p<0,1

Within the intensity of buyer and supplier co-operation, the regression models suggest a positive and significant linear relationship in company size. While we acknowledge the linear relationship, we also observe that the greatest difference in both product and process innovation are associated with firms employing between 50-99 staff. While the evidence within this study is in line with the literature, Forsman and Rantanen (2011) proposed a different threshold for optimal SME size to support innovation (20-49 employees). Existing literature on organisational size and its impact on innovation has not provided a conclusive evidence as to whether firm's size contributes to higher innovative capability. Most studies reveal a positive impact between the firm size and innovation productivity (e.g. Aiken and Hage, 1971; Damanpour, 1992; Camisón-Zornoza et al. 2004; Lejarraga and Martinez-Ros, 2014). Literature suggests it is for reasons like, greater financial position of medium sized over small firms (Laforet, 2009), more specialised, de-centralised units within large firms supporting innovation (Damanpour, 1992) or sufficient financial and human resources to support innovation (Aiken and Hage, 1971). However, there are contradicting studies that suggest organisational size does not provide differentiating results on innovative capabilities (e.g. Baregheh et al. 2016). While company size impact on innovation was not a specific area of this study, the findings provide additional insights into the influences of innovation and set foundations for further research in this area.

## 4.5. Discussion

This paper analyses linkages between upstream and downstream collaborations and firm's innovation activities. Specifically, we explore and integrate intensity (degree of relationship strength) and breadth (quantity of relationships) of collaborations and assess their impact on product and process management of Polish and Czech firms. In line with Nieto and Santamaria (2007) and Zeng et al. (2010) we observe varying impacts of external linkages on innovative activities.

### 4.5.1. Intensity (Depth) of Co-operation

Analysing the intensity of collaborations, we focused on the depth of relationships in upstream and downstream co-operations and their impact on SME innovations. As part of multivariate regression analysis, we have been able to confirm following outcomes regarding the intensity (depth) of the relationship:

Table 12. Summary results – Intensity (depth) of co-operation

| | **Evidence of linear relationship** | **Evidence of curvilinear relationship** |
|---|---|---|
| **Depth of relationship** | | |
| Buyer Cooperation on process innovation | Yes | No |
| Buyer Cooperation on product innovation | Yes | Yes |
| Supplier Cooperation on process innovation | Yes | No |
| Supplier Cooperation on product innovation | Yes | No |

In line with previous literature (e.g. Oke et al., 2013; Hottenrott and Lopes-Bento, 2016), our results confirm significant and positive impacts of upstream and downstream collaboration on product and process innovations, hence hypothesis H1 is supported (see Table 1 and 3). For the upstream collaboration in process innovation and downstream collaboration in product innovations our findings are consistent with Freel and Harrison (2006). In the new product development, the effective involvement of suppliers is dependent on effectively information sharing, mutual understanding and trust (Larson, 1991; Hoegl and

Wagner, 2005). In process and product innovation we observe a moderating effect of company size within both up and downstream collaborations. This aligns to Verreynne et al. (2012) who recognise larger firms being more exposed to innovation activities and competition. In addition, SMEs from CEE economies tend to be more effective in process innovations (Lewandowska et al. 2016) and firm size may further strengthen their comparative advantage.

Given that c46% firms in the sample belong to a micro segment, we build on Redondo and Fierro (2007) and recognise that company size affects buyer / supplier supply chain relationships. We believe company size could moderate the intensity of the associations. For instance, our results show positive signs for *company size* coefficient and we argue that the greater the firm's size and more intense the co-operation between a focal firm with its buyers or suppliers, the better are the results for product and process innovation. As a focal firm grows, we believe that certain organisational characteristics will change impacting the quality of buyer / supplier collaborations. For instance, as a micro firm expands or hires more specialised resources, its ability to process a more detailed information exchange with co-operating partners will improve translating into enhanced buyer / supplier relationships (McDowell et al., 2009). As almost half of the sample in our study represent micro firms, we add to the literature by recognising a moderating effect of firm size on the intensity of the relationships between a focal firm and its co-operating partners in either up or downstream associations. However, due to resource constraints in micro firms, the ability of such firms to continue absorbing the contextual knowledge may deteriorate if associations become over-intensive. Especially, in buyer arrangements, overly intensive exchange of information may lead to decision problems for a focal firm in extracting the most relevant and insightful knowledge that would support new product development. We argue such collaboration arrangements may lead to diminishing returns in innovations as observed in our study and be especially relevant for micro firms, due to their limited resources to exploit all the benefits from the over-intensive associations with buyers.

In relation to the intensity of collaboration activities, we note higher significant values for process innovations than product innovations. The higher factors in upstream collaborations are in line with Ageron et al. (2013) in which firm's more frequently and with greater focus engaged in upstream collaborating activities. This also aligns with Un and Asakawa (2015) where upstream collaborations have been found to provide the greatest impact on process

innovation as suppliers build contextual knowledge of the firm, hence positively influences process innovation.

Finally, the results of multiplicative dummy analysis suggest, that for the same level of buyer / supplier co-operation intensity, process innovations levels for Polish firms are lower as compared with their Czech counterparts. This adds to findings of (Danik et al., 2016) who noted Czech firms are more focused on product innovations to the greater extent as Polish firms. Overall, the econometrical results are in line with our theoretical expectations and provide interesting insights into the analysis of innovation in CEE markets.

### 4.5.2. Breadth of Co-operation

Analysing the breadth of collaborations, we explored whether the number of co-operating partners impacts innovation. Below table provide the summary of the multivariate regression analysis for the breadth of co-operation:

Table 13. Summary results – Breadth of co-operation

| | **Evidence of linear relationship** | **Evidence of curvilinear relationship** |
|---|---|---|
| **Breadth of relationship** | | |
| Number of Buyers on process innovation | No | No |
| Number of Buyers on product innovation | No | No |
| Number of Suppliers on process innovation | Yes | No |
| Number of Suppliers on product innovation | Yes | No |

Our results provide evidence for significant and positive influence of breadth in upstream collaboration on process and product innovation. However, we cannot conclude similar effects appear in downstream collaboration. Hence, hypothesis H2 is only partially supported. These findings may have few explanations. Love et al. (2014) suggest that breadth of linkages increases firm's ability to learn from the partnerships and allows to maximise value when engaged with external collaborations. This is particularly important for upstream co-operations as diversification of partners may reduce risks of dependency on

few core suppliers (Uzzi, 1997). Takeishi (2001) also suggests firm engaging with upstream collaboration need to evolve their internal capabilities to effectively absorb knowledge from multiple partnerships. In our study, we note positive and significant effects of upstream collaboration on both product and process innovations. Specifically, the results for product innovation complement earlier findings of Lewandowska et al. (2016) who noted Polish SMEs to be more cost-advantageous, hence more likely to compete in process as opposed to R&D intensive product innovations.

Recognising that almost half of the sample consists of micro firms, our results are in line with McDowell et al. (2009) and Redondo and Fierro (2007) as we recognise that micro firms are especially affected by lack of technological, financial and human resources. Nevertheless, in addition to our earlier results on intensity, we confirm the importance of supplier relationship in the context of breadth of supplier associations. In this setting we are in line with Roper and Hewitt-Dundas (2017) who recognised that micro firms often generate "new-to-the-market" innovations once they are engaged in relationships with multiple external partners.

The lack of significance in the breadth of downstream collaborations may relate to difficulties in engaging and involving of customers. There could be few reasons for our findings. For instance, Tether (2002) notes difficulties in customers' responsiveness as a barrier to innovation activities. Von Hippel (1986) observed customers may be focused on entire product characteristics from today's standpoint which may not necessarily represent the needs of tomorrow's customer.

### 4.5.3. Relational Embeddedness

The third aspect of our study related to analysis of embeddedness in supply chain relationships focused on innovative activities. The hypothesis H3 assessed whether diminishing or negative returns exist if firms over-engage in intensive relationships or if they co-operate with extensive number of supply chain partners. Our results provide support for the evidence of curvilinear relationship for product innovation in intensive downstream collaborations and hence Hypothesis H3 is partially supported. In line with Laursen and Salter (2006) firms increasing draw upon knowledge from external sources to intensify innovation activities and our findings suggest that deep integration within downstream co-operation may further lead to diminishing innovative returns. Our findings are also in line with Hottenrott and Lopes-Bento (2016) who noted focal firm innovative performance

shows diminishing returns with growing intensity of co-operation beyond certain threshold. Furthermore, Tomlinson and Fai (2016) noted a curvilinear relationship in supplier co-operation over product innovation and we add to these findings by suggesting buyer co-operation in product innovation may also exhibit non-linear characteristics.

There could be several explanations to evidence of curvilinear relationship in buyer co-operation over product innovations. First, in downstream relationships, integration costs, monitoring or intensified coordination activities may significantly impact the character of the innovative output (Hottenrott and Lopes-Bento, 2016). Second, in the downstream collaboration for product innovations firms may fall within highly embedded environments preventing them from accessing novel information or when customers are more inclined to improve existing products rather than searching for radical innovations (Uzzi, 1997). Third, it may be related to the ‘’lock in’’ effect in which customers and focal firm are too close to each other becoming likeminded and hence hampering the product innovativeness (Bjerke and Johansson, 2015). Finally, we could set a further hypothesis, that firms over-engaging in downstream relationships beyond certain threshold impede their product innovativeness as the variety of knowledge exchange, differentiated inputs and recommendations may overwhelm focal firm’s absorptive capacity to select and materialise on most relevant inputs (Love et al., 2014). A further explanation could be drawn if we link our over-embeddedness findings with the results for breadth of associations for downstream product innovations. As noted earlier, the number of downstream relationships has not significantly influenced neither product nor process innovations. This lack of significance suggests, focal firm product innovation is more sensitive towards the intensity of the downstream relationships rather than its quantity. We could argue that the quality of the downstream association, its relational proximity and strength determine whether and at which point the product innovation is at its maximum or when it starts to experience diminishing and negative returns. Our findings point towards a dynamic relationship between focal firm and intensity of its downstream relationships adding to the literature a further insight into the relational embeddedness within downstream supply chain associations.

Assessing the curvilinearity, we also estimate the optimal level of buyer collaboration construct for which product innovation is at its maximum. Although construct definitions may differ between scholars, we add the optimal level of collaboration intensity as a further variable to assess sensitivities of supply chain associations.

Finally, in the breadth of co-operations, similarly to Leiponen and Helfat (2010) we do not find diminishing returns for both up and downstream collaborations. This could be related to suggestions of Leiponen and Helfat (2010) where firms employ strategies in which they broaden their co-operative base to increase their odds by collaborating with multiple partners. As we note in our results, we propose that it is not the number of supply chain relationships but their relative quality, intensity and embeddedness that impacts innovative output.

### 4.5.4. Discussion of results in the context of Central & Eastern European supply chain innovation

As our study uses unique data sets from Polish and Czech economies it is important to discuss the results in the context of CEE market specifics, their approach to supply chain innovation and co-operation. In our attempt to assess the collaboration influence on innovation, we study both Polish and Czech firms within the context of CEE economies. Both markets frequently focus on adoption of innovation or technologies from more developed economies (Qi and Ongena, 2019) and are now re-aligning their strategies towards more innovation-creating character of their economies. While both markets have seen a strong three decades of prosperity and in 2018 both Poland and Czech Republic rank as 23rd and 45th biggest economies in the world respectively[25], their inter-firm collaboration metrics lag as compared with the EU-average. Thus, a more attention will need to be placed in the studied economies towards building more effective collaborative arrangements which support knowledge exchange and stimulate innovative capabilities.

For instance, The Europe 2020 Competitiveness Report[26], ranks Poland and Czech Republic as 22nd and 18th respectively in terms of competitiveness and points out certain structural and managerial issues. In Czech Republic, the relative low level of innovativeness, bureaucratic barriers and deterioration in educational and training assessments have contributed to the scores (Europe 2020 Competitiveness Report, 2014). Similarly, Poland's rank has been attributed to relatively low level of patent applications and adoption of digital technologies (Europe 2020 Competitiveness Report, 2014). While both markets entered EU in 2014 they share some similarities as to innovative capabilities which are predominantly based on entrepreneurship, import of technology or cheaper labour force (Mikolajczyk, 2015). We

[25] World Economic Outlook Database. International Monetary Fund (2018).
[26] The Europe 2020 Competitiveness Report. World Economic Forum (2014)

draw several interesting observations while we bring together the findings of our study and analyse them in context of Central & Eastern European supply chain innovation.

Our study on intensity of innovation provided an evidence for linear relationship for both buyers and supplier co-operation on product and process innovation. This is in line with findings of Mizgajska (2009) indicating that Polish SMEs are inclined to pursue product innovations in line with their strategies to search for product novelties to establish an advantageous position on the market. For Czech firms, our results are in line with observations of Stejskal et al. (2016) noting that co-operation with external partners for Czech SMEs positively impacts product innovative capabilities. However, for process innovations, we note slightly lower values for Polish firms as compared to Czech counterparts and we believe there could be number of reasons for it. For instance, Pavlinek and Smith (1998) noted factors such as proximity to Germany and Austria supporting the cross-border trade or long manufacturing tradition from the previous centrally planned economy that allowed Czech firms to become a leading recipient of foreign direct investments and focus on improvements in production processes. This proximity to developed markets may have contributed to more customer-oriented activities observed by Robinson and Stubberud (2013) arguing that Czech small firms are more inclined to co-operate with customers.

Furthermore, in the context of intensity of collaborative activities, our findings provide evidence for a non-linear relationship in buyer co-operation on product innovation. In the Polish context these findings expand earlier observations of Zastempowski, M., Przybylska (2016) noting a positive impact of buyers (customers) involvement in product innovations, while at the same time recognising these co-operating activities may not necessary provide ground-breaking results. In line with observations of Watson (2007) we note that over-embedding in networks may be counter-productive as efforts and time are not effectively allocated to networks that support greatest innovative performance. In the context of Polish and Czech firms the reasons of our findings could be threefold.

Firstly, in line with Bal-Woźniak (2010) the importance of structural and corporate governance improvements is necessary to support the climate for innovative activities and it applies to both analysed CEE markets. The managerial systems in the studied economies are still re-directing their attention from suppliers to customers and we may observe certain nuances as to how relationships are built and sustained. For instance, in many instances the

character of relationships between partners is opportunistic or short-sighted (Podmetina and Smirnova, 2013). To overcome this, policy makers need to direct their attention to develop human capital, establish network structures with new competences helping firms to co-operate and supply education for manager's that has been limited over the period of centrally planned economies (Bal-Woźniak, 2010).

Secondly, Sudolska (2013) noted that mutual trust, common goals and partner's assets complementarity are the three critical sources for successful co-operation fostering innovative activities in Polish firms. Hence, the intensity of supply chain co-operation may have a varying impact depending on the context of collaboration and partner's behaviour contributing in some situations to decreasing or even negative benefits (Brito et al., 2014). In the context of analysed CEE economies, we found evidence for such non-linear relationship and some aspects of it may relate to the three factors identified by Sudolska (2013).

Finally, developing partner's co-operation skills may play a role in our study. With the move from centrally planned to performance-based globally oriented market economy, certain skillsets need to be developed, especially these related to effective communication with collaborative partners. We argue, there are social factors affecting innovation in both Poland and Czech Republic and personal attributes of managers influence co-operative outputs to the varying impact as compared to developed markets. Wadhwa et al. (2017) in the study on international active Czech SMEs, note the importance of human and social capital in the technological innovation. The Czech CEO's who have been either embedded in the international networks of customers or have acquired professional knowledge of R&D are more inclined to support technological innovations in their firms (Wadhwa et al., 2017).

Turning into the breadth of co-operation partners, we observed a linear relationship between number of suppliers for both product and process innovation. Our results in the context of Polish SMEs are in line with earlier observations of Robinson and Stubberud (2013) noting that Polish small firms are more likely to name suppliers as co-operating partners. Moreover, both CEE markets have transformed their economies since the EU accession in 2004, however the main pillar of co-operation remained on synchronisation of trade economic activity (Cieslik, 2014) which may explain why both CEE markets rely on the breadth of supplier co-operation. In our study we do not observe nonlinear relationships for the breadth of supplier co-operation and we believe firms may engage in co-operative arrangements with

number of suppliers to reduce risks associated with trust (Sudolska, 2013) or relative short-tenured and opportunistic relationships (Podmetina and Smirnova, 2013).

## 4.6. Concluding Comments

### 4.6.1. Research Contribution

Our paper makes several contributions. First, by jointly assessing breadth and depth of supply chain relationships we add to the literature as previous studies mostly focused either on breadth or depth of associations. Second, we distinguish between product and process innovations both within depth and breadth of relationships and hence add to the earlier research by studying more distinct and differentiated impacts of supply chain activities on innovation. Third, we explore unique set of data from two CEE economies that have attracted limited research attention in the past. Finally, we observe curvilinear relationships in the intensity of buyer-cooperation over product innovation which demonstrates an interesting and new insight into the characteristics of downstream collaborations. Overall our paper contributes to the growing field of research in supply chain innovations and expands our understanding about the complexities and varying impacts supply chain decisions may have on the innovative output of a focal firm.

### 4.6.2. Managerial Implications

From the managerial perspective, our study provides number of recommendations. First, as our findings suggest, product innovation may experience diminishing returns when focal firm over-engages in downstream relationships, hence managers shall pay greater attention to the degree of strength in associations with existing buyers. Over-embeddedness in downstream relationships may lead to inefficient time allocation and contribute to situations where product innovations resolve unique needs of certain customer group rather than address product desires of wider population. In the setting of CEE economies, SMEs aspiring to achieve enhanced product innovations, should focus their attention on moderating the co-operation intensity levels with buyers while at the same time ensuring relationships with their suppliers are deep and long lasting. However, for managers in CEE economies, particularly focused on improvements in process innovations, it is worthwhile to note the linear relationships observed in our study in relation to buyer and supplier co-operation in process innovations. Managers should strengthen the intensity of up and downstream collaborations and focus on process improvements and knowledge exchange. As firms in

CEE economies frequently face limited financial resources to develop radical product innovations, managers should aspire for intensive collaborations in process innovations.

Second, we found that number of buyers does not significantly affect innovation, hence managers shall focus more on the quality and strength of relationships rather than on number of downstream collaborations. However, in the context of analysed CEE economies, we also note that managers should develop communication and collaboration skills to overcome barriers and historic challenges stemming from centrally planned economies, especially in the context of sustaining lasting co-operative relationships supported with trust.

Third, we observed that both the breadth and depth of upstream co-operations positively impacts product and process innovations, therefore managers should ensure their suppliers are effectively engaged, connected and integrated within the supply chain innovative networks. In the setting of studied CEE economies, we note the importance of engagement in supplier networks. Managers in Poland and Czech Republic, recognising financial and knowledge constraints, should leverage on the assets and know-how available within suppliers, especially as the increasing strength or breadth of such relationships does not lead to diminishing innovative returns. Broadening the supplier networks and ensuring it is characterised by long-term intensive relationship supports both product and process innovations.

Finally, we point towards the dynamic relationships in inter-firm collaborations and encourage managers to continuously assess the effectiveness of current associations by establishing thresholds and observing incremental gains from either deepening the relationships or expanding into new collaborative networks.

### 4.6.3. Limitations and areas for further research

This study has its limitations. The presented framework assesses intensity and breadth of associations for Polish and Czech SMEs. As in every research, we had to define construct definitions in line with previous literature. However. as presented by Churchill (1979) variations in construct definitions may lead to challenges in comparing results in empirical studies. Hence, research on breadth and depth of associations and their impact on innovative capability may not be easily comparable if constructs definitions are different. Hence, future studies may enhance the construct definition to include a broader variety to narrow or expand the definition of intensity and breadth of associations. The other limitation relates to the

lower number of Czech observations in our sample which may in some instances pose challenges to generalise our findings to wider SME population.

Building on this research, future studies could emerge in areas where intensity and breadth is even more integrated and interrelated. For instance, by assessing how the degree of strength of association changes with the incremental addition of collaborating partner. Such study could explore potential trade-offs between optimal number of collaborating partners and the intensity of association, hence build on the optimal co-operation levels introduced in this paper. Furthermore, future scholars could expand on the company size sensitivities and link them with the degree of strength and relational embeddedness by asking a research question, what is the optimal firm size to support intensive and broad vertical relationships. Finally, potential future research could focus on exploring buyer over-embeddedness in product innovations and expand our findings by suggesting optimal models for downstream collaborations that moderate the effects of diminishing or negative returns.

## 4.7. Appendix

### 4.7.1. Appendix A – Industry structure of the dataset

| Industry | n | % |
|---|---|---|
| Production | 92 | 28.66% |
| Construction | 33 | 10.28% |
| Retail and Wholesale | 34 | 10.59% |
| Hotels and restaurants | 1 | 0.31% |
| Transport | 2 | 0.62% |
| Telecommunications | 8 | 2.49% |
| Financial Services | 23 | 7.17% |
| Health | 2 | 0.62% |
| Other | 126 | 39.25% |
| **Total** | **321** | **100%** |

### 4.7.2. Appendix B – ANOVA on control variables for Polish and Czech data

| Control Variables | | N | Mean | Standard Deviation | Std. mean error | t-Test |
|---|---|---|---|---|---|---|
| Spend on R&D | Poland | 282 | 2.88 | 1.429 | .085 | 1.725 |
| | Czech Republic | 39 | 2.46 | 1.335 | .214 | |
| Company size | Poland | 282 | 1.92 | 1.213 | .072 | -0.743 |
| | Czech Republic | 39 | 2.08 | 1.494 | .239 | |
| Main owner share | Poland | 282 | 4.74 | 1.677 | .100 | -0.731 |
| | Czech Republic | 39 | 4.95 | 1.776 | .284 | |
| Firm Age | Poland | 282 | 23.91 | 18.63 | 1.10946 | 0.663 |
| | Czech Republic | 38 | 21.84 | 13.26 | 2.15195 | |

### 4.7.3. Appendix C – Variable construction (survey items used)

**Product Innovation**: (1) The number of new product lines introduced, (2) the number of changes/improvements to existing product lines.

**Process Innovation:** (1) The Number of new equipment / technologies introduced in the production process, (2) the number of new input materials introduced in the production process, (3) the number of organisational changes/improvements made in the production

processes (based upon: Molina-Morales and Martinez- Fernandez, 2006, 2009; Tomlinson and Fai (2016)). Scale 1-7; where 1 = None, 2 = low level, and 7 = A great many etc.

**Company size:** Based on number of employees with categories: less than 10, 10-49, 50-99, 100-149, 150-199, 200-250, greater than 250. Based upon Yam et al. (2011). Although firms with greater number of employees than 250 are not considered SMEs per EU definition, the survey enables this response as a method of control. Based upon Ortega-Argilés et al. (2005)

**Spend on R&D:** Percentage of firm's turnover spend on R&D (including product, process and activities developed in-house or in collaboration); Scale from 0%, 1-5%, 6-10%, 11-20%, 21-30%, greater than 30%. Based upon Tomlinson and Fai (2016)

**Firm Age:** firms were asked to specify the year of the start of firm's activities. To compute the age, items were subtracted from the year 2017. Based upon Ortega-Argilés et al., (2005)

**Share of main owner:** scale from: less than 25%; 25%-50%; 50%; 50%-75%; 75%-100%; 100%. Based upon Ortega-Argilés et al. (2005)

**Buyer Co-operation (intensity):** (1) improving product quality, (2) new product designs, (3) exchange of information / experiences, (4) marketing and distribution of products, (5) product organisation, (6) technological upgrading. Scale 1-7; where 1 = Never, 2 = Rarely (less than 10% of cases), and 7 = every time. Based upon Tomlinson and Fai (2016)

**Supplier Co-operation (intensity):** (1) improving quality of inputs, (2) exchange of information / experiences, (3) improving delivery times, (4) labour training, (5) production organisation, (6) technological upgrading. Scale 1-7; where 1 = Never, 2 = Rarely (less than 10% of cases), and 7 = every time. Based upon Tomlinson and Fai (2016)

**Buyer Co-operation (breadth):** firms were asked to specify with how many buyers do they co-operate. Scale in buckets indicating range of co-operating partners: (1) 0-5, (2) 6-10, (3) 11-15, (4) 16-20, (5) 21-30, (6) >30. Based upon Gebreeyesus and Mohnen (2013).

**Supplier Co-operation (breadth):** firms were asked to specify with how many suppliers do they co-operate. Scale in buckets indicating range of co-operating partners: (1) 0-5, (2) 6-10, (3) 11-15, (4) 16-20, (5) 21-30, (6) >30. Based upon Gebreeyesus and Mohnen (2013).

## 4.7.4. Appendix D – Descriptive Statistics (both for depth and breadth of associations)

| *N=321* | Mean | Standard Deviation | Cronbach's Alpha | Variance Inflation Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product Innovation | 4.209 | 1.820 | 0.825 | N/A | 1 | | | | | | | |
| Process Innovation | 3.703 | 1.632 | 0.798 | N/A | 0.611** | 1 | | | | | | |
| Number of Buyers | 5.000 | 1.552 | N/A | 1.271 | 0.113* | 0,051 | 1 | | | | | |
| Number of Suppliers | 3.881 | 1.819 | N/A | 1.530 | 0.256** | 0.256** | 0.436** | 1 | | | | |
| Spend on R&D | 2.846 | 1.409 | N/A | 1.042 | 0.324** | 0.338** | -0,099 | 0,052 | 1 | | | |
| Company Size | 1.938 | 1.248 | N/A | 1.507 | 0.192** | 0.205** | 0.175** | 0.460** | -0,056 | 1 | | |
| Main owner share | 4.778 | 1.670 | N/A | 1.026 | -0,034 | 0,038 | -0,038 | -0,106 | -0,089 | -0.117* | 1 | |
| Firm age | 23.669 | 18.073 | N/A | 1.249 | 0,095 | 0,077 | 0,03 | 0,074 | -0,061 | 0.317** | -0,033 | 1 |

**p<0.01 ; *p<0.05

| *N=321* | Mean | Standard Deviation | Cronbach's Alpha | Variance Inflation Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product Innovation | 4.209 | 1.82 | 0.825 | N/A | 1 | | | | | | | |
| Process Innovation | 3.703 | 1.632 | 0.798 | N/A | 0.611** | 1 | | | | | | |
| Buyer Co-operation | 3.85 | 1.447 | 0.858 | 1.403 | 0.264** | 0.383** | 1 | | | | | |
| Supplier Co-operation | 5.184 | 1.08 | 0.803 | 1.413 | 0.242** | 0.341** | 0.529** | 1 | | | | |
| Spend on R&D | 2.846 | 1.409 | N/A | 1.035 | 0.324** | 0.338** | 0.142* | 0.081 | 1 | | | |
| Company Size | 1.938 | 1.248 | N/A | 1.242 | 0.192** | 0.205** | 0.101 | 0.089 | -0.056 | 1 | | |
| Main owner share | 4.778 | 1.67 | N/A | 1.014 | -0.034 | 0.038 | 0.018 | -0.025 | -0.089 | -0.117* | 1 | |
| Firm age | 23.669 | 18.073 | N/A | 1.239 | 0.095 | 0.077 | -0.013 | 0.023 | -0.061 | 0.317** | -0.033 | 1 |

**p<0.01 ; *p<0.05

## 4.7.5. Appendix E – Company Size analysis

| | | Innovation | | Process Innovation | | Product Innovation | |
|---|---|---|---|---|---|---|---|
| ***Employee number*** | **N** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** |
| Fewer than 10 | 150 | 3.55667 | 1.548691 | 3.3736 | 1.65578 | 3.8233 | 1.87543 |
| 10-49 | 100 | 4.06400 | 1.491763 | 3.8300 | 1.57527 | 4.4150 | 1.69529 |
| 50-99 | 42 | 4.50317 | 1.465794 | 4.2222 | 1.66042 | 4.9167 | 1.61893 |
| 100-149 | 14 | 4.50000 | 1.141524 | 4.4286 | 1.15046 | 4.6071 | 1.49587 |
| 150-199 | 6 | 4.233 | 2.099206 | 4.2222 | 1.86984 | 4.2500 | 2.54460 |
| 200-249 | 3 | 5.000 | 1.509967 | 4.7778 | 1.07152 | 5.3333 | 2.88675 |
| greater than 250 | 6 | 3.600 | 0.903327 | 3.3889 | 1.10387 | 3.9167 | 1.56258 |
| ***Total*** | **321** | **3.91** | **1.54** | **3.7031** | **1.63205** | **4.2087** | **1.82047** |
| | | | | | | | |
| ***F-test*** | | **3.339*** ** | | **2.723*** ** | | **2.814*** ** | |
| significant at 1% level | | 50-99 employees | | 50-99 employees | | 50-99 employees | |

***p<0.01; **p<0.05;
*p<0.1

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# 5. Paper Three: Challenges and Enablers

<table>
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<tr><td>Signed</td><td colspan="5">Kazimierz M Kelles-Krauz</td><td>Date</td><td colspan="3">30/11/2018</td></tr>
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# Challenges and Enablers to Innovation within Small and Medium Enterprises in Central and Eastern European Economies. Evidence from Poland and Czech Republic

**Abstract**

A growing number of scholars and policy makers have focused on understanding the environment in which SMEs operate to better address what supports and what challenges their innovative activities. Drawing upon survey data from 320 SMEs from Poland and Czech Republic, this paper explores different challenges and enablers to innovation for SMEs in Central and Eastern European economies. In doing so, we focus on high and low innovation capability SMEs and recognise differences in awareness to different challenges and enablers. We draw a link with management studies and strategic management perspectives to consider the importance and impact of SME's managerial and strategic attitudes on product and process innovation within a focal firm. The paper finds evidence that besides external constraints, SME managers consistently recognise challenges related to managerial and strategic attitudes. Our findings suggest that unlocking the innovation challenges is closely connected with SME awareness of managerial strategies and practices that promote innovative thinking. Ultimately, we recommend innovation policies need to put a greater emphasis on addressing managerial attitudes promoting agility in ways of working and supporting SMEs in collaborative activities.

## 5.1. Introduction

While c99% of all firms are considered Small and Medium Enterprises (SMEs) within the EU (European Commission, 2017), their comparative advantage is often influenced by regional differences, opportunities or threats. Scholars and policy makers have been studying the environments in which SMEs operate to better understand how to respond with more innovation stimulating policy measures, creating climate for business growth or guide managerial discussion into new, more innovative ways of working.

In the increasingly competitive and globalised environment, the SMEs ability to embrace innovation is one of the key elements to achieve business growth and maintain competitive advantage (Madrid-Guijarro et al., 2009). However, to engage in successful innovation, SMEs need to overcome certain challenges. These challenges are frequently categorised as internal or external barriers to innovation (Hadjimanolis, 1999; Madrid-Guijarro, et al., 2009). As firms expand they face number of internal constraints to innovation related to managerial, personal or firm's specific obstacles (e.g. Larsen and Lewis, 2007). At the same time external market forces impact firm's ability to innovate as legal, fiscal or public policies shape an environment in which firms operate (Zhu et al., 2012). As presented in our earlier chapter on SME funding diversification, access to finance features as one of the prominent barriers to innovation among SMEs (e.g. Mulhern, 1995, Hyytinen and Toivanen, 2005; Klonowski, 2012a; Wonglimpiyarat, 2015) and a constrained financing position can significantly affect firm's innovative capabilities (Hyytinen and Toivanen, 2005; OECD, 2015; Madrid-Guijarro, et al. 2016). While finance featured prominently within the SME literature (and has been covered in our earlier papers) there are other aspects that policy makers need to be aware of when designing policies supporting innovative SMEs. The visibility and understanding of these various external and internal challenges to innovation becomes key for policy makers when setting structures for effective SME supporting institutions or for SME's managers to timely address the deterrents to innovation in their firms (D'Este et al., 2012).

On the other hand, while firms identify internal and external challenges to innovation, some build strategies to respond with managerial activities to intensify their innovative performance by embracing various enablers to innovative activities. These enablers translate often into managerial attitudes to overcome innovation challenges by embracing external environments, continuously adapt firm's structure or deploy new technologies by delivering incremental improvements (Frank, 1992). These activities, combined with creation of company values such as openness, less hierarchical structures, entrepreneurship or risk taking may enable firms to foster innovation and moderate the impact of internal & external challenges on innovation (Sanz-Valle et al., 2011). In the context of CEE economies, enablers to innovation together with challenges, are often shaped by the historic influences and environments in which firms operate, however some response strategies could draw similarities with more mature Western markets and some may be culturally specific to CEE markets.

This research aims to add to the literature by expanding the scope in which we look at challenges and enablers to innovation by investigating new areas which can hamper or support SME innovative activities in CEE economies by focusing on managerial, organisational and structural challenges. Thus, the aim in this study is threefold. First, we explore differences in internal and external innovation challenges and assess whether these differences are impacting SME's innovative performance. In doing so, we use survey data from SMEs in Poland and Czech Republic to explore challenges to SME innovation, specifically focusing on product and process innovation. Secondly, we turn our attention to innovation enablers and assess differences in how various enablers impact both product and process innovation in Poland and Czech Republic. The unique set of data allows us to analyse different challenges and enablers to innovation and assess them in context of current policy debate, managerial strategic responses and country specific differences in both CEE markets.

While World Bank categorises Poland and Czech Republic as OECD high-income economies[27], our paper analyses the elements of managerial attitudes, challenges and enablers to innovation that may in some situations differ to those observed in more developed markets. For instance, 2018 Global Competitiveness Report (World Economic Forum, 2018) recognise certain challenges for business dynamism (e.g. attitudes towards entrepreneurial risk, growth in innovative and disruptive companies, time to start business) as consistent innovation obstacles for both economies. Therefore, the aim of this study is to investigate a broad set of challenges and enablers to innovation and to draw policy and managerial recommendations. Thus, we add to the literature by providing a data-led insight into SMEs innovation challenges and enablers in the context of CEE economies. The latter element is especially interesting as CEE markets have seen a continuous growth in innovativeness and internationalisation of domestic firms (Lewandowska et al., 2016). The analysed markets, Poland and Czech Republic, are the fastest growing economies within the CEE region and hence represent an interesting research subjects in the context of SME innovation measures, with specific focus on challenges and enablers to product and process innovation. While the literature on challenges and enablers to innovation in both markets is limited, this study aims to address this research gap and provide for a base for future studies in this area.

This paper follows the following structure: first we present the theoretical foundations and explore innovation challenges and enablers in the academic discourse. Second, we focus on

[27] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

the research methodology and conduct analysis of results. We then discuss our findings in the context of literature contribution and implications from managerial and policy perspective. Finally, we note research limitations and point towards further areas of research.

## 5.2. Conceptual Issues

### 5.2.1. Background on Polish and Czech SME sector

Brandt (2018) in a paper published by OECD, recognises the innovation challenges of the Polish economy mainly through relatively limited investments in R&D, weak commercialisation of innovations and limited innovation supporting activities within firms. This mainly relates to the fact that over 25 years, post 1989/1990 transformation, the economy focused predominantly on moving from agricultural economy to more advanced production adopting technologies used in more advanced markets (Brandt, 2018). This view aligns with Dziura (2012) who argues R&D investments of Polish firm firstly serve the need to equalise the competitive position of Polish firms on global markets, rather than creating a breaking through new technologies. However, OECD recognises the growing start-up scene focused on new technologies which needs to be supported with public investments in science and higher education to compete with more mature Western markets (Brandt, 2018). Outside of investments in high technologies, Polish SMEs should also intensify their co-operative activities with research institutions, increase R&D expenditures and productivity of its workers to enhance their competitive and innovative performance (Duda, 2017).

In the Czech context, Koudelková (2014) recognises the importance of innovation to grow the Czech SME sector and calls for more co-ordinated governmental response to create innovation supporting policies. This aligns with Kozubikova (2016) who note the majority of Czech SME owners do recognise the importance of innovation in their firms. Vokoun (2016) suggests Czech firms will continue the convergence path to narrow the productivity gap with Western markets, however current governmental mechanisms to support innovation should transform to be more output oriented rather than focused on purely increasing the funding supply to the firms.

## 5.2.2. Challenges to innovation

### 5.2.2.1. Internal challenges

Prior research (e.g. Hadjimanolis, 1999; Madrid-Guijarro, et al., 2009) categorises barriers to innovation as *internal* (firm specific or endogenous) and *external* (external to the firm or exogenous). Larsen and Lewis (2007) provided a classification of barriers to innovation and distinguished between financial, marketing skills, management / personal characteristics and ‘’other barriers’’. Hewitt-Dundas (2006) draws a more profound classification mainly along resource and capabilities constraints when analysing innovation impediments. Distinguishing innovation barriers by either resource or firm’s capabilities allows to focus on financial, human and organisational innovation impediments (Hewitt-Dundas, 2006).

Starting with financial challenges, prior research provides evidence for SMEs struggling with access to finance (e.g. Hyytinen and Toivanen, 2005; OECD, 2015; Madrid-Guijarro, et al. 2016, Odrobina, 2016). This often relates to shorter credit history, information asymmetry between lending institution and entrepreneur and significant inherent risks in business operations at the beginning of the firm’s existence (Hyytinen and Toivanen, 2005; Deffains-Crapsky and Sudolska, 2014; Romero-Martinez *et al.* 2010). As most of the entrepreneurs who start their business activities are unknown to banks, funding opportunities are usually constrained (Hashi and Krasniqi, 2011). Many SMEs base their success on knowledge and expertise of their staff, therefore mostly on intangible assets which are hardly an accepted collateral for bank’s lending (Deffains-Crapsky and Sudolska, 2014). The uncertain character of the venture, collateralisation level and usually initial status of firm’s investments contribute to additional concerns among lending institutions (Deffains-Crapsky and Sudolska, 2014) and lead to often higher transaction costs to compensate for embedded risks (Mulhern, 1995; Mytelka and Farinelli, 2000; Hall 2002).

Challenges with access to finance have been recognised in the literature as key factors affecting innovation (e.g. Hyytinen and Toivanen, 2005; Beck and Demirguc-Kunt, 2006; Lewandowska, 2009; Klonowski 2012a; Szczepanska-Woszczyna, 2014; Lee *et al.* 2015). Due to inherent risks associated with the innovation investment and difficulties in accessing funds, SMEs feel constrained to support the innovation process (Mytelka and Farinelli, 2000; Czarnitzki and Hottenrott, 2011). The risk averse attitude of lending institutions tends to

favour less innovative, more routine based R&D investments with potentially less long-term impact on the economy rather than cutting-edge investments that often pose execution risks (Czarnitzki and Hottenrott, 2011). Thus, costs of R&D endeavours have an impact on firm's ability to attract funding while at the same time bearing the uncertainty of the innovation outcome. However, as innovation portfolios within SMEs are usually less sizeable, given financial constraints, the risks associated with the innovation outcomes are more difficult to be spread, hence represent a more significant impact on SME's commercial performance (Bozkurt and Kalkan, 2014).

Turning into human and organisational challenges to innovation, Hadjimanolis (1999) lists three most important constraints (perceived by firm owners) as lack of time, inadequate R&D and inadequate resources (e.g. financial resources). While recognising these challenges, Hadjimanolis (1999) also argues that not all firms may be aware of internal challenges and only the advanced SMEs are able to recognise and actively overcome the constraints to innovation. Verhees and Meulenberg (2004) note that small firms often lack resources and capabilities to perform costly and time-consuming R&D activities. Thus, small firms often rely heavily on readily available technologies or ideas generated within their supply chain, hence every new collaborative arrangement and input (both resource or capabilities) has an increasingly important impact on a resource constrained small firm in their ability to generate novel solutions (Verhees and Meulenberg, 2004). This aligns with Maldonado-Guzmán et al (2017) who noted, in the study on Mexican SMEs, that deficiencies in human resources may represent a critical challenge to firm's innovative capabilities. Firm's challenges to establish appropriate human resources base, with continuous learning and development and impact on senior management could hinder firm's ability to establish a corporate culture focused on innovation and novel thinking (Maldonado-Guzmán et al., 2017). This aligns with Lesáková et al (2017) who observed, based on the study of Slovak SMEs, that quality of human resources is after financial challenges, the second most important challenge to innovation. Firms ability to attract talent, creative and future oriented thinking combined with effective talent selection will not only distinguish SMEs on the competitive market but also allow them to be more efficient in building innovative capabilities (Lesáková et al., 2017).

### 5.2.2.2. External challenges

The external barriers to innovation include competition fairness, access to financing, stability of legal, fiscal and public system (Zhu et al., 2012). Lack of product demand, concentrated

market structure or ineffective or burdensome regulations are also often considered as non-financial external barriers to innovation (Pellegrino and Savona, 2017). External competition plays an important role as well, as firms operate in a competitive environment, its degree of competitiveness will drive the focal firm aspirations to transform new ideas into successful products faster and more effectively than their competitors (Katila and Shane, 2005). This comes in addition to economic stability and governmental support that play a key part as external factors affecting SME's external environment (Maldonado-Guzmán et al., 2017).

Furthermore, Baliamoune-Lutz and Garello (2014) argue tax structure has an impact on the levels of entrepreneurship, observing that reduction in tax progressivity may have a positive impact on nascent entrepreneurship. Walicka (2014, p.79) observed, based on the study of Polish SMEs, number of external factors affecting innovation in Polish SMEs: 1) legal regulations, 2) challenges with the access to governmental funding / subsidies, 3) high bureaucracy in governmental support schemes, 4) tax system support, 5) legal requirements, 6) crisis and market instability. The vulnerability of SMEs towards changing external environment relates often to smaller customer base for SMEs as compared to larger firms and their ability to cope with the changing customer demand (Taneja et al., 2016). Hence, the uncertainty for an innovating firm that their products may not meet customer demand can act as a further deterrent to conduct innovative activities (D'Este et al., 2012).

However, Madrid-Guijarro et al (2009) argue, based on the study of Spanish SMEs, that external challenges are helping firms to become more innovative as firms strive to overcome the external challenges by implementing more process and management innovations. Contrary to internal challenges, where firm's lack of financial or human resources is a constraint to innovation, the challenging external environment may require SMEs to adopt more innovative strategies while meeting the external challenges (Madrid-Guijarro et al., 2009). This aligns with Katila and Shane (2005) who argue that external competitive environment has a beneficial impact on firm's innovative capabilities as firms strive to continue their innovative activities and external environment may act as a catalyst to their endeavours.

### 5.2.2.3. Firm attitudes and managerial strategies constraining innovation

Sieg et al (2010) note, in their study on chemical companies, three main internal managerial challenges related to innovation: (1) enlisting internal scientists to work with innovation intermediaries, (2) selecting the right problems to solve and (3) formulating the R&D

problem so that it can enable novel solutions (Sieg et al, 2010, p.285-286). In addition, the challenge with R&D problem formulation is often one of the most prevalent and difficult problem for firms to overcome, given it requires internal scientists to be embedded, integrated and aligned within the firm's strategic aspirations about the core problem that requires solving (Sieg et al., 2010). In terms of technological advancement, Taneja et al (2016) note the importance of strategic alliances which should be part of firm's managerial strategies to reduce high costs of R&D developments and risks associated with innovation outcome. Embarking on managerial strategies that promote firm collaboration but also creating an environment allowing its employees to overcome internal innovation challenges is crucial for firm's development, competitive position and healthy organisational culture (Taneja et al., 2016).

Sanz-Valle et al (2011) note that organisation's ability to learn supports technical innovation, however some aspects of firm's attitude, such as hierarchical employee structure, could represent a barrier to innovation as it hinders open communication and flexibility. In addition, cultural barriers within the organisation such as: lack of openness, no tolerance for failure and blame culture may together have an impeding impact on employee's motivation and in effect on organisation ability to innovate (Hernández-Mogollon et al., 2010). The organisational culture bound by multiple and often bureaucratic internal process together with 'general resistance to change' often leads to the inability to move the innovative ideas forward within an organisation (Dobni and Klassen, 2015).

### 5.2.2.4. Challenges to innovation within the context of CEE economies

Krasniqi and Kutllovci (2008), in their study on determinants of innovation within Polish, Czech and Hungarian SMEs, noted the importance of SME segment in the CEE economies, particularly highlighting their role in responding to systemic changes resulted from market economy reforms that required these firms to be adaptive and capable of delivering competitive products. With the enlargement of European Union (EU) in 2004, SMEs from CEE markets faced competition from more advanced EU markets and had to respond by showcasing an adaptive, flexible and focus on technological advancement (Krasniqi and Kutllovci, 2008). Klonowski (2012b) argues that SMEs technological development and ability of SMEs to embrace innovation will be key to succeed on an ever-increasing competitive EU market. However, the level of firm's innovative capability will depend on

SME's owner appetite to take risks in innovative but also unproven ideas and SME's ability to commercialise its usually scarce internal and external resources (Demirbas et al., 2011).

For Polish firms Zuzek (2014), in the study on Polish SMEs, noted three main barriers to innovation: 1) high costs of innovation, 2) manager's attitude towards risk and 3) uncertainty of innovation outcome. While Nowacki and Staniewski (2012) noted, in the study of Polish service sector SMEs, that management awareness or their knowledge is not necessarily the main impediment to innovation, the lack of financial resources is hampering the innovation most. In addition, the limited co-operation within the supply chain has also been identified as a major obstacle to innovation, recognising that efforts need to be made to build and sustain co-operative activities not only within the supply chain but also in partnerships with research institutions (Nowacki and Staniewski, 2012). The lack of human capital or knowledge is not consistently recognised as an innovation barrier (Wziatek-Kubiak and Peczkowski, 2010; Pellegrino and Savona, 2017). In situations where firm's owners are asked to identify main barriers, their know-how or technical awareness is less frequently recognised as impediment than other factors such as lack of product demand or firm's ability to secure funding (Pellegrino and Savona, 2017). On the other hand, Szczepanska-Woszczyna (2014) present a different view suggesting Polish SMEs do not often have separate R&D units within their firms, hence why know-how existing in the firm may prevent from conducting effective innovations.

Furthermore, Wziatek-Kubiak et al (2010) argue, based on the study of Polish SMEs, that there are complementarities between barriers to innovation. As challenges to innovation are often interrelated, one challenge may impact another, as when high R&D costs, lack of co-operation partner or market information together may increase the innovation costs (Wziatek-Kubiak et al., 2010). This then could intensify the uncertainty of innovation outcome as other innovation challenges have been complementarily built into an innovation barrier chain which may further deter firm's novel activities (Wziatek-Kubiak et al., 2010).

Turning into Czech firms, Hlavacek et al (2015) argue Czech legal system is heavily criticised by employers recognising its burdensome character it places on local firms. Klímová and Zítek (2006) draw attention to challenges to innovation Czech firms face in terms of access to financing, established venture capital funding or relatively low number of science and engineering graduates. The challenges with introducing new innovations are also linked with the relative strong dependence on foreign firms funding R&D investments

(Odrobina, 2016). In addition, Vokoun (2016), argue that three most innovation limiting factors for Czech firms are costs of innovation, lack of information (know-how) and skilled personnel. The need for more co-ordinated governmental response to improve educational system could contribute to greater number of better educated employees which in effect would result in lowering costs of innovation for Czech firms (Vokoun, 2016).

### 5.2.3. Enablers to innovation

#### 5.2.3.1. Firm attitudes and managerial strategies supporting innovation

Frank (1992) recognised four factors relevant for innovation support strategies that firm should adopt: 1) awareness of external environment and technical advancements which can be adopted to the firm, 2) knowledge of new technologies and ability to deploy them in the incremental way, 3) continuously enhance company infrastructure and 4) capability of innovations to be diffused in the firm's structure and corporate culture. In addition to these factors, Andreeva and Kianto (2011) argue that knowledge creation is one of the key managerial attitudes supporting innovation. Firm's strategies towards effective documentation and storage of organisational knowledge, combined with managerial strategies towards interfirm co-operation when knowledge is exchanged and company's ability to acquire knowledge from external sources is vital for firm's innovative capabilities (Andreeva and Kianto, 2011). Ar and Baki (2011) highlight the importance of firm's attitude towards creation of entrepreneurial culture within an organisation that supports, encourages and incentivises employees to promote innovative thinking. Recognising the collaborative efforts of all departments in innovation creation is crucial in firm's managerial strategies to build an inclusive environment where innovation is a continuous process rather than a one-off activity (Ar and Baki, 2011). This aligns with Fredericks (2005) suggesting firm's innovative capabilities and new product development benefit when firms organise themselves around cross-functional teams that involve members of various departments who become strategic partners in the process of innovation development. This supports improved communication and alignment towards a common goal, creating the new product development more efficient while at the same time enhancing firm's human capital (Fredericks, 2005).

In terms of organisational culture Sanz-Valle et al (2011) suggest managers, when designing strategies to foster innovation, should focus on development of company values such as openness, less hierarchical employment structures, flexibility, external orientation, entrepreneurship and risk taking. One of the core elements of the organisational culture is related to Human Resources Management as a function that sets policies and procedures to treat employees fairly and develop their potential in line with organisation goals (Kane et al., 1999). Recognising the role of individual employee, creating learning and development culture aligned with firm's attitude to achieve long-term rather than short-term profits contributes to employee's readiness for change and more active role in firm's organisational culture effectively leading to more efficient innovation management activities (Haffar et al., 2014). Dobni and Klassen (2015) argue manager's attitude should be to orient the firm around innovation as a central theme, recognising its long-term character and ability to measure the progress in innovation developments. This combined with streamlined governance structure and supported with innovation and leadership trainings will allow a focal firm to advance its innovation agenda (Dobni and Klassen, 2015).

Turning into firms' collaboration activities, managerial strategies to embed into co-operative arrangements may support innovative capabilities as firms are inclined to 'share the pain', especially when costs of R&D endeavours or uncertainty around outcome of innovation are high (Antonioli et al., 2017). However, once a focal firm experience multiple challenges to innovation, co-operation may not necessarily provide innovation benefits given that intensification of co-operation across multiple fields where a firm faces a challenge may not be easily possible (Antonioli et al., 2017). Firms should also be aware of diminishing returns associated with over-embeddedness in co-operative arrangements, especially recognising that there might be optimal depth in relationships post which benefits of co-operation may reduce (Tomlinson and Fai, 2016). Hence, SMEs should constantly review their network partner base to ensure their partnerships are both long-term in nature but also value adding in terms of new technologies, knowledge sharing and support in joint collaborative activities of new product development (Dufour and Son, 2015).

### 5.2.3.2. Enablers to innovation within the context of CEE economies

Kmiotek and Lewicka (2008) note the following items as crucial to enable innovation in Polish firms from human resources perspective:1) creation of innovation supporting mechanisms within performance management, 2) creation of appropriate organisational

culture that fosters innovative thinking, 3) establishing competences based on trust and partnership between employees, 4) ability to easily share knowledge within a firm. In addition, co-operation with customers, research institutions and similar companies from a cluster has been recognised as beneficial for innovative activities of Polish SMEs (Zastempowski and Przybylska, 2016).

Turning to Czech SMEs, Ehrenberger et al (2015) argue that legal status of a firm determines the level of innovativeness in Czech Republic, suggesting that limited liability firms tend to be more innovative than firms of other legal structure. With limited liability firms in Czech Republic, often being owned by sole entrepreneurs (sole-traders), the focus and attention is placed more intensively on novel thinking as compared with larger firms employing greater number of employees where innovative agendas may be diluted (Ehrenberger et al., 2015). In line with prior research (e.g. Katila and Shane, 2005; Madrid-Guijarro et al., 2009), external barriers to innovation in Czech Republic, have not been confirmed as real deterrents to innovation with exclusion of co-operation with research institutions or significant market competition (Ehrenberger et al., 2015). On the other hand, Ehrenberger et al (2015) argue Czech governmental institutions should focus their efforts in expanding employee educational trainings, enhance innovation funding schemes and support Czech SMEs with their internationalisation agendas.

## 5.3. Research Methodology

The focus of this study is to investigate specific enablers and challenges to innovation in the context of two CEE economies, Poland and Czech Republic. We investigate SMEs from both countries, analyse their responses to enablers and challenges to innovation and draw managerial and policy conclusions.

### 5.3.1. Sample

In 2015 email surveys were sent to Polish and Czech SMEs across four sectors: manufacturing, trade, services and construction. The total sampling frame of 2907 Polish and Czech SMEs was created by a specialised research agency[28] in a controlled manner in line with recommendations for online surveys using third-party data base providers (Furrer

[28] ABM Media (http://www.abmmedia.com.pl/)

and Sudharshan, 2001; Evans and Mathur, 2005). To select the sampling frame, we drew representative random samples from four main industries (manufacturing, trade, services, construction) used by Central Statistical Office of Poland[29] as reference. The sample's representativeness was analysed by comparing the sampling frame with the distribution of SME population used by Central Statistical Office of Poland. This analysis revealed no significant differences between sampling frame and the target population. In total, 321 valid responses received (11% response rate); this represented a sampling error of 5.2% at the 95% confidence interval, which is within acceptable limits for survey research (Oerlemans *et al.*, 2006).

Finally, to reduce the possibility of common method bias, some items in the questionnaire have been reversed. The anonymity of respondents has also been assured to enable truthful responses. In addition, The Harman's single-factor test was performed in which all variables were loaded into the factor analysis where the largest factor accounted for 11.8% of variance explained. In summary, a common method bias is not a major concern in this study (Podsakoff *et al.,*2003).

### 5.3.2. Questionnaire and variable construction

The questionnaire used in this research is based on the practice of previous studies (see Appendix B). Firms were asked about their company data, research and development activities, source of financing and co-operative ties over the past five years. Most questions are based on the 7-point Likert scale. The primary variables of interest are described below:

***Innovation (both product and process)***

Previous studies often used categorical measures to capture innovative output, for instance distinguishing between radical (i.e. new) or incremental (i.e. improvements) for product or process innovations (e.g. De Propris, 2002). However, these types of innovation measures may often be misinterpreted by survey respondents as reliability of these measures are usually context dependent and rely on subjective assessments (Katila, 2000). This research follows Molina-Morales and Martinez-Fernandez (2006, 2009) and Tomlinson and Fai (2016) where respondents were asked questions on the number of new products introduced, alterations to existing products and changes to the production process over the period of last five years. These are frequency-based measures and in line with Tomlinson and Fai (2016)

[29] http://stat.gov.pl/en/

questions asked in the survey aimed to cover for widest possible sphere of innovative activity rather than purely focusing on patents. The 7-point Likert scale was utilised, and firms were categorised in compliance with the EU guidelines[30]. In addition, mean scores and standard deviation across all items listed in Appendix B have been calculated.

***Challenges to innovation (both product and process)***

Firms were asked questions on various challenges when introducing innovative ideas. The survey captured answers in the 7-point Likert scale to cover for a wide range of responses. The possible answers related to financial and firm's strategic aspects of what could constitute a challenge to introduction of innovations. Mean scores and standard deviations for each variable have been calculated and are reported in Appendix C.

***Enablers to innovation (both product and process)***

Firms were asked questions on various enablers that support introduction of innovative ideas. Similar to earlier questions, the survey captured answers in the 7-point Likert scale to cover for wide range of responses. The possible answers related to financial (e.g. governmental financing / subsidies, etc.) and firm's specific strategies (e.g. co-operation, trainings, organisational review, etc.) that support introduction of innovations. Mean scores and standard deviations for each variable have been calculated and are reported in Appendix C.

### 5.3.3. Descriptive Statistics

The Appendix C provides details of the descriptive statistics for all 321 SMEs used in the sample. For each construct, Cronbach's alpha (α) is reported, enabling the assessment whether items in the sample are related or share a proportion of common variance. of 'convergent validity'. A high Cronbach's alpha score indicates that sample of items performs well in capturing the construct which motivated the measure (Churchill, 1979, p. 68). In this study, all constructs showed Cronbach's alpha greater than 0.7 thus satisfying the condition for internal consistency and reliability (Nunnally, 1978; Clark and Watson, 1995; Morera and Stokes, 2016). The assessment of 'face validity', which analyses the theoretical reasoning for using particular scale items, was satisfied by utilising previously used multi-scale items, as discussed above and presented in Appendix C. In addition, the Variance

[30] Based upon EU recommendation 2003/361 where staff headcount: (1) Medium-sized companies < 250; Small < 50; Micro < 10; (2) turnover or balance sheet total respectively: Medium-sized ≤ EUR 50m or EUR 43m; Small EUR 10m; Micro EUR 10m

Inflation Factors (VIFs) have been calculated to detect multicollinearity, a case when variance of regression coefficient is inflated because of collinearity (O'Brien, 2007). In summary, all VIFs in this demonstrate values close to 1 indicating that multicollinearity is unlikely an issue in this study (O'Brien, 2007).

### 5.3.4. Analytical techniques

The aim of this study is to explore whether there are significant differences for various innovation *challenges* and *enablers* between high and low innovation level SMEs from Poland and Czech Republic. The approach used in this study follows Tomlinson (2011) where SMEs are divided into two mutually exclusive groups of low and high innovation SMEs. The first group consists of firms with innovation levels lower than mean level of innovation for the sample. The second group of high innovation performing SMEs had their innovation levels higher than the mean innovation level of the sample. Dummy variables have been introduced to distinguish the two groups, with value of 1 designated to low innovators and value of 2 to represent high innovators. The high and low innovation performing SMEs have been divided based on their performance in both product and process innovation.

The analytical technique, Analysis of Variance (ANOVA), has been used to conduct the analysis. First, this allowed a comparison of individual importance of the variables (both challenges and enablers) towards both product and process innovation. Secondly, in addition to the aggregated ANOVA, a further analysis has been conducted to test country specific differences towards individual challenges and enablers to innovation. The details of variable creation and survey questions are listed in Appendix B. All analytical techniques have been performed using SPSS v.22 analytical software (SPSS, Inc., Chicago, IL, USA).

## 5.4. Results

The ANOVA provides some interesting and significant results. The significant differences in means for high vs. low innovation performing SMEs may indicate various level of importance of each relevant challenges or enablers to innovation. These significant differences may reflect the relative innovative performance of a firm or firm's awareness and ability to respond to challenges in a way that supports innovation. Below sections

provide an overview of statistical analysis and more detailed discussion is presented in section 5 below.

### 5.4.1. Process Innovation

In terms of process innovation challenges, the aggregate ANOVA (see Table 1) shows significant differences in means (at $p<0.001$ level) for three variables (i.e. regulatory issues with patent registration, high R&D costs and firms self-perception of 'no need to innovate more'). For the first two (i.e. regulatory issues and high R&D costs), the means for high innovative firms are higher than for low innovative firms. Highly innovative firms appear more concerned with regulatory issues and seem to have greater awareness of the higher R&D costs.

For the latter significant result (i.e. 'we don't need to innovate more') the means for high innovation performing firms are lower than their counterparts in lower innovative firms' group. This is an interesting result as it transpires that high innovation performing firms, despite higher innovation results, recognise the need to continuously develop their innovative capabilities. As they do so, they are able to remain in the higher innovation capability group while their counterparts in lower innovation capability group demonstrate a lower managerial ambition or managerial dynamism to innovate. However, recognising that c46% of our sample firms belong to a micro segment, the explanation of results for "we don't need more innovation" may point towards few insights. Our findings may relate to characteristics described by Miller and Toulouse (1986) suggesting management personality could affect organisational characteristics of small firms. For instance, with CEOs having a strong desire to control firm's destiny, it may lead to management ability to design and implement change agenda leading to successful innovations as such managers often take a longer-term view on firm strategies (Miller and Toulouse, 1986). On the contrary, firms with lower management dynamism or transformational leadership as characterised by Matzler et al. (2008) may not benefit from vision and leadership that supports the intrinsic motivation of staff to purse innovative thinking.

We may also argue that micro firms are greatly focused on *survival* or *stable growth* rather than base their existence on engaging in break-through innovating activities. In a micro firm setting, Hadjimanolis (1999) recognises that a main internal barrier to innovation relates to owner-manager's time. With the frequent competing priorities requiring owner's time, the attention is mainly placed on activities requiring urgent resolution, hence are frequently

short-term focused and thus crowd-out attention for a more strategic thinking that support innovation (Hadjimanolis, 1999). Second, c50% of sample belong to three main industrial sectors (i.e. production, construction, retail & wholesale). For low process innovation capability firms, the finding of "we don't need more innovation" may suggest that these sectors are not necessarily driven by innovation in their business strategies.

**Table 1 Challenges to process innovation**

| **PL&CZ** | **Low process innovation capability firms** | | | **High process innovation capability firms** | | | **F-test** |
|---|---|---|---|---|---|---|---|
| ***Challenges to innovation*** | **Mean** | **SD** | **N** | **Mean** | **SD** | **N** | |
| Regulatory issues with patent registration | 3.24 | 1.87 | 166 | 4.07 | 1.64 | 153 | -4.21*** |
| High R&D Costs | 4.42 | 1.95 | 166 | 5.18 | 1.44 | 153 | -3.94*** |
| Uncertainty in respect to the outcome of the innovation | 4.60 | 1.73 | 166 | 4.84 | 1.56 | 154 | -1.31 |
| Other ways to spend funds rather than R&D | 4.13 | 1.78 | 166 | 4.10 | 1.60 | 152 | 0.15 |
| Challenges with new distribution channels (commercialisation challenges) | 4.11 | 1.60 | 166 | 4.41 | 1.56 | 153 | -1.72 |
| Firm's self-perception ("we don't need more innovation") | 3.48 | 1.91 | 166 | 2.54 | 1.60 | 152 | 4.74*** |

****p<0.001; **p<0.01; *p<0.05;*

In terms of enablers to process innovation, we confirm three significant differences in means at $p<0.001$ and one at $p<0.05$ levels. The first three results (i.e. involvement in working groups to improve processes, continuous review of organisational structure and co-operation with other firms) demonstrate for high innovation performing SMEs higher means as compared with low innovative firms. Although at $p<0.05$ level, the governmental funding has also been recognised as an enabler to process innovation, however its availability may be a restricting factor for firms to fully benefit from the subsidies.

**Table 2 Enablers to process innovation**

| PL&CZ | Low process innovation capability firms | | | High process innovation capability firms | | | F-test |
|---|---|---|---|---|---|---|---|
| ***Enablers to innovation*** | **Mean** | **SD** | **N** | **Mean** | **SD** | **N** | |
| through trainings and seminars | 3.78 | 1.90 | 166 | 4.08 | 1.69 | 153 | -1.46 |
| through governmental funding / subsidies | 2.04 | 1.46 | 165 | 2.41 | 1.77 | 153 | -2.00* |
| through involvement in working groups to improve processes | 2.72 | 1.75 | 166 | 3.73 | 1.89 | 153 | -4.95*** |
| through continuous review of organisational structures | 2.90 | 1.64 | 166 | 3.95 | 1.77 | 153 | -5.53*** |
| through participation in conferences | 3.51 | 1.77 | 166 | 3.82 | 1.86 | 153 | -1.50 |
| through co-operation with other firms | 3.87 | 1.69 | 166 | 4.48 | 1.62 | 153 | -3.25*** |

****p<0.001; **p<0.01; *p<0.05;*

### 5.4.2. Product Innovation

In terms of challenges to product innovation, we confirm three significant differences in means (i.e. regulatory issues with patent registration, high R&D costs, commercialisation challenges and firm's self-perception of 'no need to innovate more'). Regulatory issues and firm's self-perception are both significant at $p<0.001$ level, similar to earlier results on process innovation. The high R&D costs shows slightly lower significant values ($p<0.01$) as compared to process innovation, however still demonstrate statistically significant results, recognising the importance of high R&D costs as a challenge to innovative firms. While, all three discussed challenges remain important to both product and process innovation, the challenges with commercialisation of new distribution channels are new to firms focused on product innovations. This is interesting result and may indicate that high innovation performing firms recognise the challenges with commercialisation of their products more frequently than firms that innovate less.

**Table 3 Challenges to product innovation**

| PL&CZ | Low product innovation capability firms | | | High product innovation capability firms | | | F-test |
|---|---|---|---|---|---|---|---|
| ***Challenges to innovation*** | **Mean** | **SD** | **N** | **Mean** | **SD** | **N** | |
| Regulatory issues with patent registration | 3.29 | 1.868 | 157 | 3.98 | 1.683 | 162 | -3.430*** |
| High R&D Costs | 4.48 | 1.907 | 157 | 5.08 | 1.560 | 162 | -3.060** |
| Uncertainty in respect to the outcome of the innovation | 4.61 | 1.750 | 157 | 4.83 | 1.542 | 163 | -1.211 |
| Other ways to spend funds rather than R&D | 4.04 | 1.790 | 156 | 4.18 | 1.595 | 162 | -0.706 |
| Challenges with new distribution channels (commercialisation challenges) | 4.05 | 1.580 | 157 | 4.45 | 1.565 | 162 | -2.270* |
| Firm's self perception ("we don't need more innovation") | 3.39 | 1.846 | 157 | 2.69 | 1.753 | 162 | 3.492*** |

****p<0.001; **p<0.01; *p<0.05;*

In terms of enablers to product innovation, we confirm same significant results as for process innovation. All three enablers (i.e. involvement in working groups to improve processes, continuous review of organisational structure and co-operation with other firms) remain statistically significant at p<0.001 level. The results also show higher means for high innovation performing firms suggesting firms that innovate more, frequently recognise the importance of these enablers and include them in firm's strategic decisions to support innovation.

**Table 4 Enablers to product innovation**

| PL&CZ | Low product innovation capability firms | | | High product innovation capability firms | | | F-test |
|---|---|---|---|---|---|---|---|
| ***Enablers to innovation*** | **Mean** | **SD** | **N** | **Mean** | **SD** | **N** | |
| through trainings and seminars | 3.82 | 1.878 | 158 | 4.03 | 1.725 | 162 | -1.064 |
| through governmental funding / subsidies | 2.13 | 1.494 | 156 | 2.30 | 1.741 | 162 | -0.887 |
| through involvement in working groups to improve processes | 2.79 | 1.751 | 157 | 3.60 | 1.929 | 162 | -3.919*** |
| through continuous review of organisational structures | 2.99 | 1.683 | 157 | 3.81 | 1.785 | 162 | -4.225*** |
| through participation in conferences | 3.46 | 1.749 | 157 | 3.85 | 1.864 | 162 | -1.880 |
| through co-operation with other firms | 3.85 | 1.729 | 157 | 4.47 | 1.581 | 162 | -3.355*** |

****p<0.001; **p<0.01; *p<0.05;*

### 5.4.3. Country specific differences to both challenges and enablers to innovation

The analysis of country specific differences aimed to demonstrate whether significant differences in means exist between Polish and Czech SMEs towards specific challenges or enablers to innovation.

In terms of challenges to innovation, there have been two significant differences between Polish and Czech SMEs. First related to firm's decisions to spend funds in an alternative way rather than on R&D activities. The means were higher for Polish firms, indicating Polish SMEs more frequently face decisions whether to support R&D activities or use funds for alternative initiatives. The second significant result related to firm's self-perception ('we don't need to innovate more') that also demonstrated higher means for Polish SMEs. We discuss these results in more details in the subsequent section.

**Table 5 Country specific analysis of challenges to innovation**

| | PL | | | CZ | | | T-test |
|---|---|---|---|---|---|---|---|
| ***T-test*** | **Mean** | **SD** | **N** | **Mean** | **SD** | **N** | |
| Regulatory Issues with patent registration | 3.67 | 1.815 | 282 | 3.38 | 1.738 | 37 | 0.935 |
| High R&D Costs | 4.84 | 1.742 | 282 | 4.35 | 1.874 | 37 | 1.603 |
| Uncertainty in respect to the outcome of the innovation | 4.72 | 1.656 | 282 | 4.68 | 1.613 | 38 | 0.137 |
| Other ways to spend funds rather than R&D | 4.19 | 1.683 | 282 | 3.50 | 1.665 | 36 | 2.325** |
| Challenges with new distribution channels (commercialisation challenges) | 4.30 | 1.552 | 282 | 3.92 | 1.785 | 37 | 1.371 |
| Firm's self perception ("we don't need more innovation") | 3.12 | 1.82 | 282 | 2.43 | 1.819 | 37 | 2.151** |

****p<0,01; **p<0,05; *p<0,1*

Turning into enablers to innovation, we confirm four significant differences in means between Polish and Czech SMEs. All the significant results are at p<0.01 level and relate to trainings / seminars, continuous review of organisational structures, participation in conferences and co-operation with other firms. Across all the significant results, Polish SMEs demonstrated higher means indicating that these enablers to innovation are more frequently important to their firms as compared to Czech counterparts.

**Table 6 Country specific analysis of enablers to innovation**

| | PL | | | CZ | | | T-test |
|---|---|---|---|---|---|---|---|
| ***T-Test*** | **Mean** | **SD** | **N** | **Mean** | **SD** | **N** | |
| through trainings and seminars | 4.01 | 1.821 | 282 | 3.26 | 1.519 | 38 | 2.430** |
| through governmental funding / subsidies | 2.27 | 1.637 | 282 | 1.83 | 1.483 | 36 | 1.508 |
| through involvement in working groups to improve processes | 3.17 | 1.864 | 282 | 3.43 | 2.049 | 37 | 0.795 |
| through continuous review of organisational structures | 3.50 | 1.808 | 282 | 2.70 | 1.392 | 37 | 2.571** |
| through participation in conferences | 3.77 | 1.811 | 282 | 2.78 | 1.618 | 37 | 3.161** |
| through co-operation with other firms | 4.23 | 1.662 | 282 | 3.62 | 1.754 | 37 | 2.094** |

****p<0,001; **p<0,01; *p<0,05*

## 5.5. Discussion

In this study we have analysed selected challenges and enablers to product and process innovation among SMEs from Poland and Czech Republic. In the following sections we discuss our results and conduct a review of country specific differences.

### 5.5.1. Enablers to innovation

Both for process and product innovations, we observe highly innovative firms to be more likely engaging in collaborative activities, reviewing organisational structures, participating in working groups to improve processes and striving to access governmental funding. Our findings related to co-operative activities align to some of the findings in earlier research (Radas and Bozic, 2009). With frequently resource constrained SMEs, managers are required to draw more intensively from the existing network of actors and partnerships and that is where the organisational setup and management adaptability is playing increasingly more significant role in innovation supporting strategies (van de Vrande et al., 2009). As presented in our earlier study on firm's collaborative activities, there are different strategies SME's managers may employ to strengthen the output from the co-operation, especially in the context of process innovation. For instance, our earlier study suggests SMEs are positively benefiting from upstream collaborative activities as it is likely that suppliers build more contextual understanding of their co-operating partner, hence foster process innovations within a focal firm (Un and Asakawa, 2015). Analogous to process innovation, we note highly innovative SMEs are aware of the impact of cooperation on product innovation. Hence, our results are in line with Lasagni (2012) who argues customer / supplier co-operation, allows SMEs to bring new products faster to the market and improve design quality.

In the context of micro firms, which are significantly represented in our sample, we are in line with Roper and Hewitt-Dundas (2017) that collaborative activities remain important for micro-enterprises. Roper and Hewitt-Dundas (2017) argue that new to market product innovations occur mainly where owner-manager of a micro firm possess a technical knowledge or expertise. We expand this finding and suggest that, besides technical knowledge, owner-managers also influence the organisational firm setting which may support more conducive environment for product innovations.

Therefore, we also note, in line with earlier research (e.g. Radas and Bozic, 2009), that highly innovative firms are more likely to recognise changes to organisational structures as enabling forces supporting process innovation. While our findings suggest highly innovative firms are more aware of the importance of constant review of organisational structures, Radas and Bozic (2009) argue changes to organisational structures may raise the probability of incremental innovations (as opposed to radical innovations) as it is likely that firms improved organisational structures contribute to process improvements rather than breakthrough product innovations. Chen and Chang (2012) note that organisational structure may have a twofold impact on innovation. First, a formalised organisational structure may increase the absorptive capacity within an organisation, hence positively contributes towards innovation. On the other hand, a too formalised organisational structure may restrain from fast decision-making process and hence contribute to a reduction in the organisational innovative capability (Chen and Chang, 2012). Sciulli (1998) recognised that organisational structure formalisation is more frequently associated with process innovations, as more centralised decision making together with tight rules and regulations may restrain firms from the inflow of new ideas and hence limit the innovations to the production process improvements, rather than implementation of new radical products.

While in our study we confirm manager's awareness of importance of continuous review of organisational structure in the context of both product and process innovations, we believe that SMEs from Poland and Czech Republic are flexible in their approach towards organisational structures review given that predominant share of SMEs are classified as micro-firms where organisational structures tend to be rather less formalistic (European Commission, 2017). Thus, for micro firms, we argue that attention to organisational re-design is a natural element of their day to day operations. As shown in our results, managers are not only aware of importance of organisational structures review but also recognise a need to support innovations by creation of working groups with the purpose to generate creativity and value adding products or processes. Therefore, we believe firms in our sample (and micro firms in particular) do not operate with hierarchical or formal organisational structures and are often guided by owner-manager who performs a leading role in tasks allocation and division of work. This is in line with West (2002) who recognises the importance of group innovation and creativity, however argues, that innovation in groups requires solid task characteristics, diversity of skills and knowledge, external demands and integration of processes in which a group should operate (e.g. managing conflicts, supporting

innovation, decision making, etc.). Additionally, organisational structures of firms may also differ among each other due to diversity of operations they perform, and the role of owner-manager is key to influence the character of the working environment (Matlay, 1999).

Finally, our findings confirm managers' awareness of a likely positive support of governmental funding for high process innovation capability firms. This is in line with Doh and Kim (2014) who note, in their study of South Korean SMEs, the positive impact of governmental funding on the number of patent registrations and new design registrations. This, however, is also dependent on the SME's ability to secure sufficient R&D personnel to capitalise on the available funding as frequently SMEs are constrained with the ability to appropriately staff their research departments (Doh and Kim, 2014). On the other note, and with a view on emerging markets, Radas and Bozic (2009) argued, that innovation subsidies are not linked to innovativeness as often governmental subsidies are poorly designed and only a fraction of SMEs is able to benefit from them. This view may be partially supported in our results, hence a relatively weak relationship (at 5% significance level) of governmental financing on process innovation (and no confirmed relationship for product innovation). Furthermore, as our results are based on two CEE economies, we believe our findings are in line with the observations of Kapil et al. (2013) in their World Bank study suggesting Polish SMEs tend to use the governmental funding (incl. EU innovation funds) to absorb (i.e. procure) the technology into their firms rather than use the funds to promote innovative new breakthrough products. It is argued, such approach is explainable as Polish firms focused on bringing the technology to par levels with European counterparts and this process over the past decade could have contributed to Polish SMEs better withstanding recent economic crisis than many other Western-EU countries (Kapil et al., 2013). Most of Polish SMEs' R&D projects are financed from firm's own funds, hence public funding just marginally supports the R&D endeavours (Kapil et al., 2013). In line with our suggestions from earlier paper on diversified funding base, World Bank's study of Kapil et al. (2013) promotes a wider usage and access to a broader spectrum of financial instruments (e.g. switching from grants to more revolving instruments, increase share of flexible repayment instruments rather than purpose-oriented financing of innovation, etc.). By diversifying access to financial instruments SMEs can enhance their innovative capabilities but need to be aware of the diminishing returns of over-diversifying as presented in our earlier paper.

### 5.5.2. Challenges to innovation

Turning to challenges, we note that awareness of challenges to innovation is an important factor in the discussion on the innovation levels. In our study, we note significant differences for high R&D costs, pressures with regulatory environments and firm's self-perception that prevents from innovating. Starting with R&D costs, we are in line with Lasagni (2012) who argued that SMEs are reluctant to accept uncertainty in relation to the outcome of a risky innovative project, hence their ability to embrace external knowledge by fostering innovation stimulating collaboration will be crucial to sustain competitive position. Furthermore, linking our results with earlier World Bank's research by Kapil et al., (2013), the tendency for public spending is to support larger firms with absorptive attitude to technology rather than innovative SMEs at their earlier (hence riskier) stage of innovation process. Finally, the high R&D costs are likely linked with the SME's challenges to access financing (e.g. Hyytinen and Toivanen, 2005; OECD, 2015; Madrid-Guijarro, et al. 2016, Odrobina, 2016) which we discussed in our earlier research on diversified funding base. This may explain our results suggesting SME managers are often faced with high funding costs that ultimately increase the R&D costs. This may hamper the innovation process or have a slightly nuanced result. For instance, Euchner (2015) noted in an interview with Barry Jaruzelski (Partner of a consulting firm Strategy& and author of a research study based 10,000 data points) that throwing excessive funds into R&D not necessarily is the answer to increase firm's innovative capabilities. The other corporate strategy cornerstones such as effective decision making, portfolio management, marketing, distribution, and ultimately a cohesive strategy is likely to have a greater impact on successful R&D project than higher R&D spending, which leads to higher R&D costs (Euchner, 2015).

Our findings in terms of challenges with patent registration are in line with the actual statistics. For instance, EBRD study by Breznitz and Ornston (2017) notes that with 12.7 patents per million inhabitants to the European Patent Office in 2013, Poland's figures are lower than EU average (113.3) but also lower than in Czech Republic (23.2). While these data show a relative weak performance in terms of patents for Polish enterprises, the explanation could be twofold. First, Sierotowicz (2015) argues that while the increase in patent activity is influenced by increased R&D spending, the efficiency of management of R&D activity has a long-term impact on the patenting activity. Noting the important role of strategic vision, resource allocation and ability to predict the results of R&D spending could influence the performance of firm's patenting activity (Sierotowicz, 2015). We could argue,

linking with our earlier discussion on R&D financing, that while for Polish and Czech SMEs the access to R&D funds represents one of the main challenges, the effective allocation management of these funds may not necessarily support patenting activity but is rather dedicated to acquiring and adaptation of technology (Zdunczyk and Blenkinsopp, 2007). In addition, recognising that top three industry sectors (i.e. production, construction, retail & wholesale) represent c50% of our sample, we may argue that these firms may not necessarily require or focus their business attention on patenting activities. For instance, according to European Patent Office Annual Report for 2018 the main sectors where patenting occurred related to medical technology, digital communications, computer science, electrical machinery and transport[31]. According to European Patent Office[32], in Central and Eastern Europe, Poland and Czech exhibited a very strong growth in patenting activities in 2018 as compared with 2017 (19.7% and 17.5% year or year growth respectively). However, the focus of patents in Poland related to thermal processes, transport and computer technology[33], sectors which are different to those predominantly represented in our sample.

Second, once the challenge to access the R&D funds is overcome, the focus shifts to research commercialisation. In the Polish context, research commercialisation is not well-established and is often hampered by low inter-firm collaboration activity which prevents from establishing strong domestic and foreign partnerships that support commercialisation of the research activity (Brandt, 2018). The partnership with research institutions could also strengthen performance of patenting activity, leveraging the leading university research centres in Warsaw and Silesia regions within the Polish context (Klonowski, 2012b).

Finally, we build a link to the management and corporate strategy literature relating to the last finding of our study on challenges to product and process innovation. Our results suggest low innovation capability SMEs are aware of challenges posed by certain management attitudes (i.e. ‘we don’t need more innovation’) and their likely impact on process and product innovation. Our results may represent an interesting dilemma of manager’s ability to ascertain firm’s innovative position vs. market or external trends. A possible explanation to such results could be linked with findings from Ashkenas (2012) who argues manager’s may not be inclined to innovate for three reasons: 1) firm’s manager focus on immediate results and hence may prefer their employees to concentrate first on their day to day activities

[31] https://www.epo.org/about-us/annual-reports-statistics/annual-report/2018.html
[32] https://www.epo.org/about-us/annual-reports-statistics/annual-report/2018/download-centre.html
[33] ibidem

and leave innovative thinking once all tasks are complete, hence leaving less time for innovation; 2) innovation may cannibalise existing revenue streams and manager's may not be inclined for a radical change; 3) managerial mindset focused around continuous improvement (e.g. lean six sigma) approach may have been a preferred method to improve processes rather than a search for a radical innovation that is uncertain. A further explanation could relate to Denning (2005) who analysed corporate innovation strategies and argued firms are often not willing or able to create an environment of disruptive change needed for innovation and the whole managerial approach to innovation needs re-thinking to encourage a more risk-balanced approach within innovation decision taking. Finally, our results could also be interpreted within the context of management leadership discussion and its influence on firm's organisational performance, behaviour and innovation. For instance, Matzler et al. (2008) suggests transformational leadership bound with vision and strategy has a positive effect on firm's innovative capabilities. In our case, firms with lower management dynamism or with CEO's lacking aspiration to set a longer-term vision may be faced with similar dilemma as presented in our study.

Focusing on CEE economies we may provide some further insights into our results. For instance, Zizlavsky (2011) in the study on Czech SMEs, noted the lack of firm's management interest to support innovation mainly due to inability to take risks and preference for stable and predictable returns that may be hampered by uncertainty of innovation. Often the lack of clear definition of a problem that innovation should solve prevents managers from pursuing ideas that are vague and often difficult to quantify from benefits perspective (Zizlavsky, 2011). In the Polish context, our findings align with Wziatek-Kubiak and Peczkowski (2010) who observed 'no need to innovate' challenge to be more frequently observed among occasional innovators than firms who innovate more frequently. There may be few explanations to our results when analysed in the context of CEE economies. For instance, our results may relate to previous not successful innovations or entrepreneur's perception that market doesn't require its firm to innovate as demand or customer needs are currently satisfied (Wziatek-Kubiak and Peczkowski, 2010). Other explanations may be more nuanced. Zdunczyk and Blenkinsopp (2007) noted challenges to create an innovation supporting environments within Polish firms as compared to their Western counterparts. This may relate to the management strategies or organisational structures that are not conducive to foster creativity or innovative thinking but predominantly support activities related to adaptation rather breakthrough innovation (Zdunczyk and Blenkinsopp, 2007).

Our results also point towards earlier findings of Gassmann et al. (2010) who noted the importance of cultural aspect for innovation suggesting management's mindset may play a significant role in fostering innovative activities of a firm by creating effective tools such as incentive mechanisms or strategies for continuous external orientation for best practices and innovative ideas. In addition, our results relate to findings of Hadjimanolis (1999) who recognised the involvement of firm's owner in day to day operational management. An extensive involvement may further deteriorate firm's ability to search for innovative ideas (or management willingness to innovate as shown in our results) as most of firm-owner's time is consumed with ongoing issues and in effect it reduces the firm's ability to plan or concentrate on innovation supporting activities (Hadjimanolis, 1999).

Ultimately, for micro enterprise, Roper and Hewitt-Dundas (2017) recognised mainly economic constraints (e.g. cost of finance / accessibility of finance) as barriers to innovations. We confirm these findings, noting that high R&D costs have been frequently recognised as challenges to innovation for firms in our sample. Similarly, Roper and Hewitt-Dundas (2017) noted that micro firms are not aware of the external or public support available to them to enhance innovation. We confirm that firms in our study demonstrate a rather weak awareness of governmental funding / subsidies support towards process innovation (significance at 5%) and no awareness of this enabler towards product innovation. In addition, we argue that in some industry categories innovation may not be the main driver for firms' existence. In our data sample, three main industry categories (i.e. production, construction, wholesale & retail) may not necessarily require micro firms to focus on innovation. Thus, potentially provide another explanation to "*we don't need more innovation*" finding in our study.

### 5.5.3. Discussion of country specific differences

Starting with innovation challenges, we note certain country specific differences when analysing our results. For instance, Polish firms demonstrated greater awareness of the innovation challenge 'we don't need more innovation' as compared with their Czech counterparts. In the study on Polish firms, our results are in line with Wziatek-Kubiak and Peczkowski (2010) who recognised similar observations for low innovating firms. Wziatek-Kubiak and Peczkowski (2010) also suggest that awareness of certain specific challenges may relate to 'firm's sensitivity of perception' that could be driven by market competitiveness, firm characteristics or various knowledge sources. While Wziatek-Kubiak

and Peczkowski (2010) argue the more competitive the market the greater awareness or perception of challenges, we are unable to confirm same holds true in our results. For instance, according to 2018 Global Competitiveness Report (World Economic Forum, 2018) Czech Republic achieved the highest rank (29$^{th}$) among remaining CEE markets, including Poland (37$^{th}$), suggesting there might be other firm's specific reasons, not related to market competitiveness, as to why Polish SME's suggested greater awareness of this challenge.

The second difference relates to the perception of Polish firms to utilise their funds in a different way other than on R&D activities. This finding can be linked with the earlier observation for Polish firms, 'we don't need more innovation', and while both findings may have similar explanation as presented above we would like to add a further perspective. The innovation levels of Polish firms remain weak as compared with OECD benchmarks and is characterised with a chronical underinvestment in R&D sectors, focus on productivity growth and absorption of technologies (OECD, 2015). Our findings are also in line with Mikolajczyk, (2015) who noted that expenditures on R&D in Poland are below EU average and even four times lower than EU average when considered at enterprise level. Weak tax incentives are frequently named as potential deterrent for R&D investments and policy makers should strive to achieve a more tax friendly legislations (e.g. tax exemptions, deferrals, etc.) when it comes to supporting enhanced R&D investments (Mikolajczyk, 2015). In addition, Polish firms struggle with commercialisation of their work and often face challenges to translating their R&D investments into sensible customer propositions (Klonowski, 2012b). While our results unleash certain behaviour or awareness, future studies could explore more in terms of the trade-offs between innovation R&D spending and other different ways to spend funds within SMEs.

Turning to enablers, we recognise certain country specific differences in some areas which we explored earlier. For instance, as compared with Czech firms, the means for Polish SMEs are significantly higher for enablers such as trainings, continuous review of organisational structure, participation in conferences and co-operation with other firms. These results may point towards greater awareness of Polish firms to these enablers and there could be several explanations to our results. First, Mikolajczyk (2015) argues, the sustained economic growth of Polish economy over the past two decades, relates to entrepreneurship skills and successful import of technology. Potentially, external orientation of Polish firms, especially as they focused on the import of technology, influenced the awareness of innovation enablers such as inter-firm co-operation. However, as Pavlinek and Smith (1998) noted, the proximity

of Germany and Austria for Czech firms had an impact on the cross-border trade as well and clearly may have influenced co-operation abilities of Czech firms. While both markets recognised the importance of co-operation we may argue that Polish firms' awareness of this enabler could have emerged more recently than for Czech firms given that Czech-German collaboration have already had a very established history of collaboration and sizeable foreign direct investment flows between Germany to Czech Republic (Hecht, 2015).

Lastly, as we observed in an earlier section on innovation challenges, Polish SMEs seem to prefer to utilise their funds in other ways rather than on R&D investments. This finding is consistent with EBRD paper by Breznitz and Ornston (2017) noting that the share of R&D spend to GDP is at 0.94% which is significantly lower than EU average (2.03%) but also significantly lower to Czech Republic (2.0%). While the lower spend could represent a challenge to innovation, it may also point towards a greater inclination for Polish SMEs to recognise the importance of firm's organisational culture in enhancing innovative activities by reviewing organisational structures, enhancing knowledge by attending trainings or conferences, rather than focusing on R&D investments. The explanation to this finding is in line with Moilanen et al. (2014) who suggested firms recognise improvements in SME's innovative performance may come from number of sources, some of them being outside of the firm and relate to networks, collaborations, customers or from external knowledge sources (e.g. trainings or conferences). Our findings are also in line with Mazur and Zaborek (2016) who suggested that in the process of constant organisational learning, Polish SMEs are supporting their innovative culture and hence contributing positively towards the enhanced innovative capabilities.

### 5.5.4. Results in the context of policy implications

Szymura-Tyc (2015) brings an argument of an 'unfinished' transition process that may delay certain developments affecting innovativeness of the economy. In the Polish context, Szymura-Tyc (2015) note relative high share of state-owned enterprises, high share of micro-enterprises or in some respects delayed privatisation as a reasons why Polish firms show relatively lower levels of innovativeness as compared to Western markets. While some of this analysis may hold true, we would like to provide a further angle into the way we look at the policies recognising the results of our study.

First, in line with findings of Szabo et al. (2013) related to the comparative innovative performance of CEE economies, the policy makers in both Poland and Czech Republic need

to place a greater emphasis on the entrepreneurship and the way it is thought and brought to live in the SME context. Focusing on learning entrepreneurship skills starting with high schools and universities, together with setting up support schemes to enable creation of new SMEs will be essential in the strengthening of the current SME environments. Our recommendations build on the management science and organisation culture literature (e.g. Matzler et al., 2008; Sanz-Valle et al., 2011; Andreeva and Kianto, 2011; Taneja et al., 2016) and suggest organisational behaviour and management attitude towards innovation in Poland and Czech Republic require a more centralised impulse from policy makers. For instance, while we observe high innovation capability firms share awareness of the importance of organisational adjustments to support innovation (e.g. constant review of structures, working groups) the management attitudes may often hamper the innovative activities (e.g. 'we don't want to innovate more'). Recognising that Polish firms post 1989/90 focused predominantly on adopting technical knowledge (Zdunczyk and Blenkinsopp, 2007) the policy maker's support should now focus on intangible assets by strengthening the human capital by transforming it to more specialised, aligned with industry needs and focused on management and organisational concepts that will support firms to be more effective in both product and process innovations (Breznitz and Ornston, 2017). To make the learning more efficient and accessible to wider SME community we recommend, in line with Brandt (2018), that there needs to be a greater role in advocating for existing solutions (both from funding, technical and knowledge perspective) to support innovation in Poland and Czech Republic. Raising awareness of existing options to support innovation and enhanced communication will contribute to addressing or at least mitigating the managerial attitude challenges found in our study.

Second, strengthening the inter-firm collaboration should be on the top of policy agendas for both Polish and Czech policy makers. Based on our results in this paper but also in line with our earlier chapter on collaboration, SMEs from both markets benefit from enhanced innovation capabilities once co-operation activities accelerate. Our recommendation is in line with European Bank for Reconstruction and Development (EBRD) paper by Breznitz and Ornston (2017) suggesting firms should actively engage in collaborative activities and policy makers are required to establish platforms for initiatives that support collaboration, such as pilot programmes, exchanges or experimentation with new product launches. In the Polish context our recommendations are especially relevant given that share of Polish innovating SMEs collaborating with each other in 2017 is at 3.5%, fourth lowest in the EU

and three times lower than in Czech Republic (European Commission, 2018, p.89-90). One of the approaches would be to base the EU innovation subsidies on the condition of inter-firm collaboration activities similarly to recommendations from Brandt (2018), in the OECD study, suggesting EU subsidies should be linked to the degree of co-operation between industry and research institutions. Our suggestions in this respect go a bit further and we believe that formalising the inter-firm collaboration and connecting them to the EU innovation subsidies would strengthen both Polish and Czech SMEs aspirations to look beyond their existing network of partners.

Finally, we recommend policy makers place a greater emphasis on strengthening the SME capabilities in research commercialisation. In line with observations in our study, SMEs in Poland and Czech Republic struggle with commercialisation of their new product innovations and are frequently challenged with high R&D costs. In effect, the R&D expenditure in the business sector for both Poland (0.63%) and Czech Republic (1.03%) remains significant lower than EU-28 average (1.32%) contributing to fewer product and process innovations (European Commission, 2018). For instance, just 13.3% of Polish SMEs (vs. EU-28 average of 30.9%) demonstrated new product and process innovations in 2017 (European Commission, 2018). Thus, to incentivise the innovation and R&D activity, we believe the focus should be on two aspects. First, policy makers should strengthen SME abilities in the research commercialisation by fostering SMEs incentives to increase expenditure on R&D activities (e.g. tax reliefs, tax credits, etc.). The commercialisation of R&D activities will be dependent on effective public policy co-ordination to establish platforms and ecosystems where solution providers (e.g. innovating SMEs) are able to connect with solution seekers (e.g. multinationals, enterprises of greater size). Second, in line with Radosevic and Stancova (2018) we note a strong dependency of Polish and Czech firms on public or EU-directed R&D funds and Foreign Direct Investments which mainly enhance production rather than innovation capabilities of analysed enterprises. Hence, policy makers should focus on establishing innovation supporting R&D programmes which allow for complementarity of private investments into R&D together with the public or EU funds. Combining it with earlier discussed condition of strengthening inter-firm collaboration will then support the development of awareness and ownership towards innovation financing, its outcome and strengthen the commercial result of the R&D activity.

We also recognise in line with Mikolajczak and Pawlak (2017) the need for flexibility in which firms need to deploy their funding base, human capital or adapt strategies for

collaborative activities to support innovation activities that will differ given the diversity of the whole SME ecosystem. We argue that the three main policy recommendations presented in our study related to strengthening managerial knowledge & human capital, enhancing collaboration activities and supporting commercialisation of R&D activity are inter-related. We believe their effects can be multiplied if policy makers address them jointly or within a coherent approach to influence the innovation capacity of SMEs in Poland and Czech Republic.

## 5.6. Concluding Comments

### 5.6.1. Research Contribution

In our study we bring additional viewpoints to look at the challenges and enablers to innovation and we contribute to a further debate on this complex phenomenon in the context of CEE economies. In line with Klonowski (2012b) we recognise there isn't a one unique list of challenges that all SMEs face, but rather there are different areas or topics that SMEs are confronted with. Broadening our understanding of these different themes may help to tailor better responses from managerial and policy perspectives. Similarly, enablers to innovation will have a more generic and specific character and none of the SMEs innovative capabilities are enabled with the same features. The aim of our study was to analyse additional, previously not explored enablers and challenges and discuss their relevance for SMEs innovative capabilities in CEE economies. Our contributions are threefold.

First, highly innovative SMEs in CEE economies demonstrate a consistent awareness of three key innovation enablers such as: 1) continuous review of organisational structures, 2) creation of environments (e.g. working groups) with the purpose to innovate and 3) strengthening co-operation activities among firms. The latter finding is in line with our earlier research on firms' co-operative activities, however the first two enablers relate to firm's internal characteristics and managerial attitudes or strategic approaches. These enablers play a significant role in driving firm's innovative capabilities and remain important for SME managers across our two analysed CEE markets.

Second, highly innovative SMEs from Poland and Czech Republic consistently recognised three innovation challenges, such as: 1) high R&D costs, 2) regulatory issues with patent

registrations and 3) management attitude ‘we don’t need more innovation’. While the first two challenges are in line with the literature, the latter finding provides a new insight into management attitudes that may hamper innovative activities. Exploring this phenomenon in more details may provide new areas of research and understanding of management strategies and behaviours which need to be addressed to strengthen firm’s innovative capabilities.

Third, our results are relevant in the context of CEE economies in general. While both Poland and Czech Republic are categorised as OECD high-income economies, the journey towards innovation-creating economies is not finished. For instance, in CEE region innovation discussion frequently focuses on tangible external factors needed for successful innovations (e.g. financing, resources, etc.), but some less-tangible managerial, strategic and organisational aspects may be overlooked (Goujard and Guérin, 2018). Therefore, Polish and Czech SMEs will require intensified attention to re-adjust their management strategies to support more innovation-creation activities rather than adoption of ideas from more developed markets. In the context of CEE economies, an effective strategy will require firms to upgrade their management strategies and overcome competitiveness challenges related to business dynamism faced presently by the Region (World Economic Forum, 2018). In addition, firms in low innovation capability firms in Poland and Czech Republic will need to build effective strategies to influence managerial aspiration (to overcome “*we don’t need more innovation*” findings).

Finally, we recommend public policies should place a greater emphasis on educating SMEs to explore and experiment with new approaches to innovations. Focusing on agility both in terms of firm’s organisational structure and internal set-ups (e.g. working groups, focus groups, innovation labs, research centres, etc.) can help SMEs to become more aware of what works and what’s not in accelerating their innovative capabilities. There should be a greater focus on SMEs culture within public policies recommendations, exploring and understanding the reasons of why certain firms ‘don’t want to innovate more’ will help to derive platforms and incentives for the whole SME ecosystem to be more innovative. Strengthening the partnerships and collaborative activities among SMEs should be the cornerstone of countries innovation-supporting public policies. Ultimately, the stronger the link between SMEs’ challenges or enablers and public policies, the more effective and promising the results can be.

### 5.6.2. Limitations and areas for further research

Our study has its limitations. Starting with the data, we recognise that relatively fewer observations for Czech Republic may limit our ability to generalise the observations to the wider SME population. In addition, we are also unable to explore the in-depth relationships between the reasons of some of the answers towards challenges and enablers and corporate strategies or management aspirations within an enterprise. This leads us to potential areas for further research where we see three possible thoughts to expand on our research.

First, a refined survey to the analysed CEE economies capturing further details as to what are the different types of management attitudes, strategies and characteristics of organisational behaviour could provide further interesting insights into our understanding of linkages between management strategies and challenges or enablers to innovation. This study could capture entrepreneur's aspirations and management dynamism and analyse specific challenges or enablers to innovation to demonstrate potentially evolving drivers that influence R&D activity.

Second, future study could explore barriers and enablers to innovation in the context of technological firms. For instance, with the growing digitisation of the economy a research question could explore whether new technically oriented SMEs focused on digital economy face similar challenges to innovation as other firms? With more interconnected global environment for technological firms, digital SMEs may face different challenges and be influenced via different factors than other SMEs. A new set of policy recommendations could emerge from this study.

Finally, we believe that a further exploration of specific challenges and enablers to innovation will provide a more detailed understanding of their impact on innovation. For instance, a new study could expand on our questions on collaboration by adding upstream, downstream and international collaboration. In addition, given the nature of Foreign Direct Investments in the new EU states recognised by Radosevic and Stancova (2018), a new study could explore more relationships between foreign vs. locally owned SMEs to capture the relative differences in their innovative performance and perceptions of innovation challenges or enablers.

## 5.7. Appendix

### 5.7.1. Appendix A – Industry structure of the dataset

| Industry | n | % |
|---|---|---|
| Production | 92 | 28.66% |
| Construction | 33 | 10.28% |
| Retail and Wholesale | 34 | 10.59% |
| Hotels and restaurants | 1 | 0.31% |
| Transport | 2 | 0.62% |
| Telecommunications | 8 | 2.49% |
| Financial Services | 23 | 7.17% |
| Health | 2 | 0.62% |
| Other | 126 | 39.25% |
| **Total** | **321** | **100%** |

### 5.7.2. Appendix B – Variable construction (survey items used)

**Product Innovation**: (1) The number of new product lines introduced, (2) the number of changes/improvements to existing product lines.

**Process Innovation:** (1) The Number of new equipment / technology introduced in the production process, (2) the number of new input materials introduced in the production process, (3) the number of organisational changes/improvements made in the production processes (based upon: Molina-Morales and Martinez- Fernandez, 2006, 2009; Tomlinson and Fai (2016)). Scale 1-7; where 1 = None, 2 = low level, and 7 = A great many etc.

**Challenges to Innovation:** (1) Regulatory issues when patents are registered, (2) High costs of R&D investments, (3) Uncertainty in respect to the outcome of the innovation, (4) Other alternative ways of spending free cash rather than for R&D investments, (5) Introduction of new distribution channels, (6) My company's business does not require increase in innovation. Scale 1-7; where 1 = strongly disagree, 2 = disagree, and 7 = strongly agree, etc.

**Enablers to Innovation:** (1) Through trainings, seminars, (2) Through governmental subsidies to enhance innovative ideas, (3) Through regular working groups with the objective to improve the processes, (4) Through continual review of organisational structure, (5) Through participation in conferences, working panels, (6) Through co-operation with

other companies. Scale 1-7; where 1 = never, 2 = rarely (less than 10% of cases), and 7 = every time, etc.

## 5.7.3. Appendix C – Descriptive Statistics

| ***Challenges to innovation*** | | | | | **Pearson correlation** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Cronbach's alpha** | **Mean** | **SD** | **N** | **1** | **2** | **3** | **4** | **5** | **6** |
| Process Innovation | 0.798 | 3.70 | 1.632 | 320 | 0.254** | 0.273** | 0.114* | 0.036 | 0.163** | -0.296** |
| Product Innovation | 0.825 | 4.21 | 1.820 | 321 | 0.153** | 0.194** | 0.107 | -0.008 | 0.150** | -0.281** |
| 1 - Regulatory Issues with patent registration | N/A | 3.64 | 1.806 | 319 | 1.000 | | | | | |
| 2 - High R&D Costs | N/A | 4.79 | 1.762 | 319 | 0.403** | 1.000 | | | | |
| 3- Uncertainty in respect to the outcome of the innovation | N/A | 4.72 | 1.648 | 320 | 0.290** | 0.563** | 1.000 | | | |
| 4- Other ways to spend funds rather than R&D | N/A | 4.11 | 1.692 | 318 | 0.215** | 0.312** | 0.404** | 1.000 | | |
| 5- Challenges with new distribution channels (commercialisation challenges) | N/A | 4.25 | 1.583 | 319 | 0.224** | 0.261** | 0.306** | 0.357** | 1.000 | |
| 6 - Firm's self perception ("we don't need more innovation") | N/A | 3.04 | 1.831 | 319 | -0.022 | -0.187** | -0.061 | 0.044 | -0.098 | 1.000 |

**p<0,01; *p<0,05

| ***Enablers to innovation*** | | | | | **Pearson correlation** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Cronbach's alpha** | **Mean** | **SD** | **N** | **1** | **2** | **3** | **4** | **5** | **6** |
| Process Innovation | 0.798 | 3.70 | 1.632 | 320 | 0.041 | 0.127* | 0.358** | 0.379** | 0.095 | 0.200** |
| Product Innovation | 0.825 | 4.21 | 1.820 | 321 | 0.045 | 0.070 | 0.256** | 0.236** | 0.080 | 0.172** |
| 1- through trainings and seminars | N/A | 3.93 | 1.802 | 320 | 1.000 | | | | | |
| 2- through governmental funding / subsidies | N/A | 2.22 | 1.624 | 318 | 0.157** | 1.000 | | | | |
| 3- through involvement in working groups to improve processes | N/A | 3.20 | 1.884 | 319 | 0.208** | 0.160** | 1.000 | | | |
| 4- through continuous review of organisational structures | N/A | 3.40 | 1.781 | 319 | 0.200** | 0.138* | 0.489** | 1.000 | | |
| 5- through participation in conferences | N/A | 3.66 | 1.815 | 319 | 0.638** | 0.198** | 0.217** | 0.280** | 1.000 | |
| 6- through co-operation with other firms | N/A | 4.16 | 1.682 | 319 | 0.305** | 0.116* | 0.244** | 0.353** | 0.358** | 1.000 |

**p<0,01; *p<0,05

## 5.8. References


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# 6. Thesis Discussion

## 6.1. Chapter Introduction

As each of the papers deals with specific influences on innovation for SMEs in CEE economies, the areas in which we analyse them are interrelated and thus the findings provide for set of connected observations. These findings relate to theoretical contributions (Section 6.2) but also to recommendations from managerial and policy perspective (Section 6.3). Hence, the aim of this section is to bring the results of the three papers into one connected summary which relates to the rationale for each paper as presented earlier (Section 1.4). Following that, the limitations identified in this study are presented (Section 6.5) in addition to the discussion of areas for future direction for research in this field (Section 6.6). We conclude with chapter summary (Section 6.7) and provide for some final conclusions and remarks related to this thesis in the last chapter (Section 7).

## 6.2. Summary of papers and theoretical contributions

In this study number of contributions have been made, including theoretical contributions, policy and managerial recommendations. While the thesis aimed to analyse three different set of influences on innovation for SMEs in CEE economies, the findings are interrelated and provide important further insights into the studies of factors affecting innovation. All set of observations are borne out of the research using unique set of data from two CEE economies, hence contributing to the literature by providing empirical evidence from a region which has not yet attracted much research debate. Although each paper makes specific contributions, the findings of the whole research thesis are interconnected and enrich our knowledge on aspects that influence innovation. For instance, adding new parameters, like *diversified funding base* we recognise other factors relevant in the debate on SME finance literature. We complement it with further analysis of co-operation within supply chain which highlights the importance of embedding into collaborative arrangements. Finally, manager's perceptions on barriers and enablers help to provide further insights into awareness of certain areas that either support or hamper innovation. These areas discussed in this research build on each other and complement our understanding on innovation influences, thus highlight the relevance of the three chosen topics for this thesis (i.e. finance diversification, co-

operation in supply chains and manager's perceptions on challenges and enablers). Furthermore, unique set of data from Poland and Czech Republic enabled to gather insights using primary data sources. Each paper discusses detailed methodological approach in which statistical analysis was conducted and defines methods of how variables were constructed. Throughout this study the focus has been on SMEs from CEE economies. The importance of SME sector in these markets has been recognised and discussed in the earlier Section 1.2 and Section 1.3. The aim of this section is not to repeat what has been discussed earlier or within the three papers but to bring the results together and expand in certain areas to contextualise the results and demonstrate the way these observations are interrelated.

Beginning with Paper One, the effects of funding diversification on innovation are explored and provide for new evidence in the SME finance and innovation literature. The results point towards dynamic relationships between firm's capital structure and innovation capabilities but also extend the recommendations of OECD (2015a) in which firms should broaden their capital base to reduce systemic risks and decrease reliance on single funding means (e.g. bank debt). The findings provide evidence for linear positive relationship between diversified funding base and both product and process innovation, recognising the importance for SMEs to incorporate funding diversification considerations when pursuing innovation supporting strategies. Furthermore, diversification of finance sources is relevant from theoretical perspective. By introducing a novel factor, *diversified funding base*, into the studies of innovation, we build a link to capital structure literature, recognising that varying level of diversification in finance sources may lead to differing results for product and process innovations. As firms become less dependent on a single finance provider and enhance their funding base diversification, both process and product innovation increases. We argue that with increasing availability of resource providers (i.e. with more *diversified funding base*), firms can experiment more freely and thus enhance their innovative capabilities. Potentially, with reducing reliance on a single resource provider, firms can expand in product or process experimentation. This may relate to the fact, that dependency to deliver commercial returns on investment to a sole finance provider decreases in favour of satisfying broader range of financiers, who in aggregation may have different risk/return expectations.

In addition, capital structure decisions are often influenced by various phases in firm's organisational life (Berger and Udell, 1998; Gregory et al. 2005; Briozzo and Vigier, 2012). Thus, availability of finance providers could differ and strategies to broaden the access to

more sources could be dependent on strategic firm's decisions in which resources are used or accessed (e.g. pecking-order theory) but also on the maturity of the market in which they operate (OECD, 2015b). Therefore, with the evidence for positive linear relationship between funding diversification and product / process innovation, we also add to the debate of entrepreneur's decisions related to capital structure. The selection of this research area and relevance of our findings are even more important in the context of World Bank (2016) study in which debt financiers (e.g. commercial banks) where recognised as funding providers that not necessarily drive firms to innovate, as opposed to VC or angel financiers where pressure from shareholders to innovate is much greater. Thus, the importance for firms to diversify their funding base, broaden the access and usage of various finance providers will not only reduce the reliance on single finance source but may also contribute to enhancing firm's innovative capabilities. To stimulate this activity, at the policy level, Poland has introduced number of programmes to allow firms to access a more diversified pool of financing (e.g. via "PARP" or "PFR" programmes), however awareness among SME owners about availability of such policies requires strengthening (World Bank, 2016).

The results of this research thesis contribute to the debate on funding diversification, add an empirical evidence and explore entrepreneur's choices to diversify firm's funding base. In addition, the results recognise difference between funding diversification on product and process innovation. While diversification of funding base impacts positively both product and process innovation, the effects of over-diversification lead to diminishing returns in product innovation. The evidence of curvilinear relationship between over-engagement in funding diversification and product innovation is novel and enhances our understanding of dynamics between finance supply and its impact on product innovation. It also recognises certain attitudes of finance providers towards innovating SMEs. For instance, most of SMEs are financed by commercial banks, that in return search for rather stable payback and sufficient collateral in form of assets or products (rather than processes) being invested in (Deffains-Crapsky and Sudolska, 2014; World Bank, 2016). As SMEs broaden the diversity of finance providers, their activities continue to focus on improvements in production process (i.e. linear evidence in process innovation), however beyond certain level of funding diversification product innovation is impacted and demonstrates diminishing returns (i.e. curvilinear evidence in product innovation). This suggests SMEs are continuously interested to re-engineer and enhance their production process capabilities (i.e. process innovation)

even when their funding base is more diverse. However, product innovation exhibits a more nuanced dynamics when diversification of funding sources is overly extensive.

In addition, our findings point towards the resource slack discussion (e.g. Nohria and Gulati, 1996) and provide further evidence for optimal resource allocation debate to promote innovative activities. As mentioned by Richtnér and Åhlström (2006, p. 400), *"attention needs to be paid to the variables influencing organisational slack, the different categories of organisational slack in product development projects and their effect on innovation"*. This thesis provides further insights into this discussion recognising that diversification of finance sources could be treated as one of the *different categories* affecting resource / organisational slack of a firm, hence having a varying impact on firm's innovation. In doing so, we provide empirical evidence for inverted U-shaped relationship for finance diversification and product innovation and draw three main conclusions. First, we recognise over-diversification of finance resources may lead to complexity in managing relationships and navigating too many finance providers, hence it could negatively impact firm's product innovative capabilities. Second, over-diversified funding base could result in finance providers pulling in different directions, focusing on less innovative projects or creating decisioning problems for firm's management to decide between most innovation-supporting strategies. Further argument may also relate to the fact that with more concentrated set of financiers, firm's attention on new product innovation is stronger but gets diluted as new set of financiers are added who may often have different product innovation objectives. Finally, we argue that over-diversification may lead to diminishing returns in product innovation due to varying time horizons and expectations of finance providers. With alternative finance providers (e.g. VCs, angels) expecting to realise gains within shorter horizon, SMEs may embark on more innovative projects first. However, as they broaden the set of funding sources, SMEs may embrace finance providers with longer term horizon that prefer more stable return rather than short term gains, thus reducing the firm's pressure to develop immediate new and critical product innovations.

Furthermore, this study develops a metric *diversified funding base* building on earlier literature in SME finance and innovation, recognising a research gap where effects of diversification in finance sources where underexplored. While future studies may expand on this metric, it builds a foundation for future research to develop this idea and further refine the measure. The study on funding diversification goes some way in providing an empirical rationale for recommendations often published by international institutions towards markets

from CEE economies (e.g. OECD 2015a) but also provides a contribution to theoretical studies on influences of innovation. In addition, the curvilinear results herein suggest a more nuanced relationship exists between diversity of funding sources and product innovation, thus opening new areas for future research in this subject discussed in more details in Section 6.6.

Expanding on entrepreneur's choices, a further area discussed in this thesis relates to engagement in supply chain collaborative arrangements to support innovation. Collaboration metrics for both Polish and Czech SMEs still lag below EU average (European Commission, 2017b), hence represent an important topic for this investigation. Building on finance diversification themes in Paper One, Paper Two investigates how embedding in collaborative arrangements within supply chain affects product and process innovation. As in Paper One, the focus is on entrepreneur's choices and objective is to analyse the decisions to ebbed into more *broad* or *intense* associations with up or downstream supply chain partners.

In terms of number of partners (i.e. breadth) the findings confirm a positive linear relationship in upstream associations, however the same has not been confirmed for downstream collaborations. Expanding the breadth of linkages with suppliers allow a focal firm to acquire new knowledge and hence create value from new partnerships. Our findings demonstrate that entrepreneur's decisions to diversify and broaden supplier base allow a focal firm to reduce the dependency on single partnerships and positively contribute to both product and process innovations.

However, in relation to intensity (depth) of associations, we provide evidence for positive linear relationships for both up and downstream collaboration on product and process innovation. While our findings are in line with prior literature (e.g. Oke et al., 2013; Hottenrott and Lopes-Bento, 2016), we discover new insights into downstream associations where evidence of curvilinear relationship in product innovation was found. While inverted U-shaped relationships have been earlier discussed in the literature, our findings build on these observations for two reasons. First, we added to the literature on CEE economies, where these findings have not been observed earlier, thus we are contributing to this research field by adding an empirical evidence from our study. Second, curvilinear relationship between depth of association with buyers and product innovation expands our knowledge on relational embeddedness in buyer co-operation and its effects on product innovation.

As firms embed in downstream associations our results demonstrate positive influence on product innovation, however beyond certain point, once these associations become more intense, the product innovation exhibits diminishing returns. This is interesting from supply chain perspective. For instance, some collaborative arrangements between small and larger firms lead to a "lock in" effect in which smaller firm is dependent on one or few core partners (Uzzi, 1997). Furthermore, in case of intensive collaborations with few core partners, firms may be embedded in innovation activities that support purely cost reductions or product improvements, rather than new breakthrough product developments (Ahn et al., 2017). In the intensive associations with buyers, firms exchange knowledge and recommendations on new products. We may argue that the overwhelming information exchange that is created with intensive relationships may impede firms from selecting the most valuable inputs required to produce new product innovations. In addition, the quality of association may also play a role in explaining our results. As firms embed in intensive downstream arrangements, it is the quality of the information exchange that will produce inputs required for innovative new product developments.

In the context of our research, the relational embeddedness is a consistent theme within the dimension of product innovations among analysed firms. In addition, the evidence of curvilinear results contributes to the theoretical frameworks which help to investigate further dynamics affecting innovation. The results of this thesis suggest there are significant sensitivities within product innovation characteristics influenced by certain entrepreneur's choices. For instance, as presented earlier, entrepreneur's decisions may in certain situations lead to overdiversification in firm's funding base or over-engagement in intensive downstream associations. Both actions may result in diminishing returns in product innovation, if embeddedness is beyond certain level. While we recognise managers are subject to number of optimisation decisions during day-to-day running of operations, dynamics related to embeddedness in funding diversification and intensity of downstream associations should be at the core of manager's agenda. Therefore, this discussion builds a link towards Paper Three which focuses on manager's attitudes and strategic decisions that either challenge or enable innovation.

Building on above themes, Paper Three investigates manager's perceptions of areas which either negatively affect or positively influence innovation. Especially in the context of policy makers but also relating to management strategies, awareness of these themes is important as firms are consistently faced with increasing domestic and international competition, thus

putting pressure on firm's innovative capabilities. Therefore, the dimension in which we assess influences of innovation should expand beyond financing (e.g. finance access, diversification, source of financing, etc.) or firm's activities (e.g. collaboration, networking, partnerships, etc.) and incorporate a wider environment that has an impact on manager's decisions related to innovation activities. While Paper Three discusses manager's perceptions on certain challenges and enablers to innovation, it also provides for policy makers' recommendations to tailor innovation supporting policies, considering the results of the study. It also builds on strategic management literature and discusses elements related to managerial attitudes and organisational strategies to influence innovation. In doing so, the Paper Three distinguishes between low and high innovation capability firms and assess a range of challenges and enablers, thus makes two distinct contributions. First, it expands on certain elements that have found some limited attention in the literature (e.g. manager's perception of "*we don't need more innovation*"). This enables a discussion of firm's self-assessment, particularly interesting for firms with low innovative capabilities. Second, the paper discusses range of policy recommendations, with the focus on CEE economies.

Moreover, in line with contributions of Paper Two, Paper Three notes that highly innovative SMEs recognise importance of engagement in collaborative activities to enable innovation. The results herein are consistent for both process and product innovation. While Paper Two provides more depth and distinction between intensity and breadth of up / downstream associations, Paper Three provides for more contextual recognition of the results, highlighting the management awareness of the importance of co-operation to enable innovation. Moreover, firms with high innovation capability recognise the importance of organisational design (e.g. working groups, review of organisational structures), hence demonstrate awareness of more structural aspects that are relevant to support innovation. This is interesting from strategic management standpoint for two reasons. First, in a resource constrained environment in which SMEs operate, organisational design could be a method in which firms adapt to be more flexible, agile and transformative to create environments that are more conducive to support innovation. Second, prior literature often connects organisational re-designs as strategic elements that more frequently support process rather than contribute to new radical product innovations (e.g. Radas and Bozic, 2009). Here our paper adds a new insight as the results herein recognise management awareness of organisational design positively affecting process as well product innovation. This may relate to a cultural or historic setting in which Polish and Czech SMEs operate. The

continuous adaptation of Polish and Czech SMEs towards new environments of market economy in CEE region, will require SME managers to focus on organisational re-design to support all aspects of innovation, rather than just process or incremental improvements.

On the other side, manager's awareness of challenges to innovation has provided some interesting empirical evidence in relation to low innovation capability firms. Managers of these firms have shared a perception of "*we don't need more innovation*", a characteristic that has so far attracted little research attention, however may represent an interesting insight into manager's self-perception against firm's own capabilities or competition. The results herein could have two possible explanations. First, the ability of managers to ascertain firm's innovative capability could relate to number of factors (e.g. knowledge of new trends, awareness of market, strategic positioning and manager's ambition, etc.) and could represent an area for future studies (see Section 6.6 for more details) that links various management strategies and manager's reluctance to pursue further innovations. Second, building on observations from Wziatek-Kubiak and Peczkowski (2010) study of low innovation performing Polish firms, our results provide further insights recognising that the reluctance to strive for more innovation is consistent across process and product innovation. The consistency across process and product innovation may relate to intangible factors such as entrepreneurship skillsets (Szabo et al., 2013), earlier challenges with commercialisation of innovation efforts (Klonowski, 2012) or administrative challenges that require centralised policy makers strategy to promote innovation activities among SMEs (see Section 6.3 for more detailed discussion on policy implications).

In addition, recognising the share of micro enterprises in our study, we add to the debate on innovativeness in micro segment. Baumann and Kritikos (2016) recognised that micro firms may face higher costs when investing in R&D as compared with larger enterprises, however once investing, these firms are similarly successful in innovation as bigger firms are. Furthermore, noting the high share of micro segment in our study, we derive further explanations to our findings. First, in the context of funding diversification, micro firms follow pecking order theory in which they use funds and demonstrate a strong reliance on bank's debt financing. In addition, we argue that adding new set of financiers may contribute towards reducing owner-manager's autonomy to pursue new (and riskier) innovations, which in effect will lead to diminishing levels of innovation. Moreover, a higher (as compared with larger firms) dependence of micro firms on availability of financial resources may strengthen the link between availability of bank's debt and innovation (Qi and Ongena,

2019). If bank's lending is already scarce, further reduction in its availability may lead to a more significant negative influence on SME innovation (Qi and Ongena, 2019). This effect may even be more severe for micro firms as their funding options are limited.

Furthermore, in a micro firm context, broadening of finance diversification beyond certain threshold could result in challenges in translating new financial resources into tangible innovative outputs. Once a focal firm overcomes funding availability issues, other challenges could be encountered. As discussed in the Paper One, new financiers may pull in different directions and thus negatively impact innovation. Satisfying varying return expectations of capital providers could also be challenging and micro firms will need to focus on ensuring that existing products provide enough revenue streams to meet new lenders' expectations. There are also internal resource constraints to translate new available financing towards new product development and require adjustment in management / organisational strategies.

Second, in the context of the intensity of collaboration, we argue that the greater the firm's size and more intense the co-operation between a focal firm and its buyers or suppliers, the better are the results for product and process innovation. However, we recognise that with overly intensive buyer associations, product innovation may exhibit diminishing returns. In the context of micro firms, we may argue that with the growing intensity of buyer associations, a focal firm is positively benefiting from a contextual knowledge and is able to generate new product innovations. However, when such associations are excessively intensive, the ability of a micro firm to absorb and exploit increasing intensity of knowledge exchange may be restricted due to its intra-firm resources being limited. In such situations, we argue micro firms may exhibit diminishing product innovations as observed in our study.

In the context of our third paper, our results also suggest there are also non-financial elements that add to the debate about innovation strategies of micro firms. For instance, Baumann and Kritikos (2016) recognised that product innovations in micro segment support labour productivity which is crucially important in a resource constrained micro firm environment. Our findings expand these suggestions by adding new enablers such as organisation design, working group setting and collaboration which are important for both product and process innovations. Furthermore, van der Vrande et al. (2009) suggest barriers to innovation may relate to managerial awareness of certain challenges. For instance, managers may not be aware of some issues, struggle to compare the status of firm's innovativeness with "best practices", or face issues to explain the challenges (van der Vrande et al., 2009). Our findings

related to “we don’t need more innovation” may relate to these explanations driven by unique characteristics of micro firms and high share of such firms in our study. However, we may also suggest that given half of the sample is represented in production, construction, retail & wholesale, firms may not be primarily driven by innovation but focused on sustaining stable and commercially viable collaborative arrangements between a focal firm, buyers and suppliers.

Finally, we note the significance of our results in the setting of CEE economies. We set the context for our study within the conditions of Poland and Czech Republic, the two economies that have undergone significant economic transformation over the past three decades. While both markets have achieved significant economic progress, their innovation metrics significantly lag developed economies and our study aimed to understand and focus on specific influences on innovation in these markets. There are number of observations we would like to make in this context. First, SMEs in Poland and Czech Republic are building their strategies to move from innovation adopters (importers) towards innovation leaders (creators). However, in this transition, SMEs in both markets demonstrate similar challenges to innovation. They struggle with access to financing, collaboration, management awareness and in certain situations management ambition towards innovation (e.g. “we don’t need more innovation” finding). However, they also exhibit interesting characteristics that may be relevant to other CEE markets. For instance, our study confirms the importance of diversification of funding sources to support innovation. The constraints in accessing financing post 2007/08 financial crisis and both markets strong reliance on foreign owned lending institutions may create environments which affect Polish and Czech SMEs. The impact may be disproportionately greater as compared to environments in which SMEs from more advanced economies operate. Mainly due to longer history of financing institutions or the number and variety of organisations that support SME lending. Our findings build arguments towards public debate to enable domestic financial markets to support diversified lending towards SMEs, which can significantly contribute towards product and process innovation in CEE economies. However, as SMEs diversify their funding bases, firm owners should recognise the over-diversification impacts on innovation once their build their financial strategies to support innovation activities.

Second, both Polish and Czech SMEs significantly lag in collaboration metrics when compared to more developed economies. As discussed in our study, both markets may engage in strategies to intensify or broaden their collaborative network to enhance

innovation. However, the impact may vary. Our findings recognise that intensive associations are important for innovation but beyond certain thresholds over-engagement in buyer collaboration may negatively affect product innovations. Gathering insights about customers and creating intense relationships with the focus on product innovations aligned to buyer's needs is key for Polish firms (Mitrega, 2012). This process will require absorptive capacity and firm's ability to respond to buyer's needs.

Furthermore, our observations related to management challenges to innovation could well be applicable to other CEE markets. World Economic Forum (2018) recognised challenges for management dynamism which are present in CEE markets and hamper innovative activities (e.e. management attitudes towards entrepreneurial risk, slow growth in innovative and disruptive companies, etc.). We expand on these and add new challenges and enablers to create a more holistic view of influences on innovation in CEE region.

Having discussed the theoretical contributions of all three papers it is now possible to revert to rationale and goals set out in the introductory Section 1.4. Firstly, the thesis aimed to understand further set of influences on innovation in CEE economies using original survey data from Polish and Czech SMEs. This has been achieved as three papers have been developed (currently in advanced form prior to the submission to ABS4 journals) using unique data related to Polish and Czech SMEs based on a survey that has been specially designed for this study. Secondly, the core of all three papers is centred around entrepreneurial choices related to firm's financing, co-operation and perception what challenges and enables innovation. These entrepreneur's decisions may lead to over-embeddedness in certain activities which then, beyond certain level of embeddedness, may translate into nuanced influence on innovation. Thirdly, each paper adds to the literature on innovation by critically assessing certain new or recognised influences and provides recommendations from managerial and policy perspective. For instance, Paper One introduces a new construct, *diversified funding base*, as a metric that further enhances our understanding of dynamic relations between firm financing strategies and innovation; Paper Two investigates firm's activities in embedding along supply chain and investigates a more nuanced relations when firm over-engages in certain associations; Paper Three then builds on earlier two papers and discusses manager's awareness towards certain challenges and enablers to innovation, which are relevant from firm's management strategies perspective but also important for policy makers interested in stimulating innovative activities in CEE

economies. While each of the papers has achieved its individual goal, the next section will discuss the practical and policy recommendations based on the findings from all three papers.

## 6.3. Practical and policy recommendations

From practical and policy perspective number of recommendations have been made to enhance firm's innovative capabilities. Each of the papers have presented its own set of recommendations and aim of this section is to bring them all together. Some of the recommendations are not easy and relate to entrepreneur's choices to embed into certain activities, however an awareness of them will allow managers to tailor management strategies. Moreover, some recommendations will also be dependent on external developments (e.g. financial markets allowing access to a broader set of financial sources) that are difficult to predict. Even if, in some instances, challenges with external environments are overcome, the affordability of certain financial instruments may hamper SMEs to take an active usage of them. On the other side, policy recommendations presented herein, build a set of advices to public institutions to set the right innovative agenda, focus on areas that have been discussed in this thesis and answer to some challenges and enablers to innovation identified by SMEs. Similarly, implementation of policy recommendations is not easy, however the aim is to draw attention towards these subjects and stimulate discussion around policy support towards SMEs.

Starting with managerial recommendations, Paper One introduces a new metric, *diversified funding base*, which should be included in entrepreneur's optimisation decisions related to financing options. As this paper recognises that SME managers are bound by the constraints of the financial markets in which they operate, the awareness of the metric is important from knowledge creation perspective. Enhancing knowledge creation is key item for management strategies to support innovation (Andreeva and Kianto, 2011) and having visibility towards new areas that influence innovation will be beneficial in entrepreneur's choices related to capital structure and future firm's aspirations.

As mentioned earlier, this thesis recognises the importance of diversified funding base and the recommendation is for policy makers to ensure diversity is possible (as often both SME awareness but also availability of broader set of financing options is not present in CEE economies). However, the responsibility for SME managers would be to recognise and monitor the engagement in which firms embrace funding diversity and how it impacts

innovation, taking into consideration over-diversification and curvilinear evidence found in this study. We believe, while financial markets offer diversity in access to funding options, it is the predominant role of SME managers to navigate the complexities associated with broader share of financing stakeholders to reduce the potential effects of over-diversification which may lead to diminishing returns in product innovation. Similarly, in the context of co-operative activities, SME managers should place a greater emphasis on quality rather than quantity of relationships. Recognising the results of this thesis, intense associations along supply chain demonstrate a linear positive impact on both process and product innovation. Increasing the number of partners was only beneficial to product and process innovation in upstream associations, suggesting firm's absorptive capacity may be constrained and greater attention should be placed on few but more intense associations that support new information exchange but reduce dependency on key suppliers (what in effect will allow for continuity of production process).

In terms of policy recommendations, broadening set of financing partners may contribute towards increased SME innovation, as presented in Paper One. This, however requires concentrated efforts from governmental and policy institutions to set foundations for number of key elements such as: 1) external agents being able to access Polish and Czech markets (to the greater extent it is today) to offer new alternatives to traditional commercial bank debt (e.g. VC, angel investors); 2) re-design tax supporting mechanisms to incentivise SMEs to access broader set of financing (e.g. by promoting tax credits if diversity of financing is at certain locally defined threshold); 3) incorporate *diversity of funding base* into the discussion of innovation supporting metrics which should be monitored and recognised in the policy setting when promoting new grants or governmental funding. In line with OECD (2015b), reducing barriers for markets to promote diversity of funding access within SME sector will create opportunities for SMEs to reduce dependency on single finance provider (usually bank debt) and incentivise engagement with other funding providers, action that in effect will contribute towards increased innovative activity. However, alternative and new ways of financing will come with differentiated costs. Thus, the role of policy makers will be to ensure diversity of access is not hampered with financing costs that will eventually drive SMEs back towards traditional means of bank finance as other sources may be too costly. As firms in CEE economies often require increased assurances (often in terms of greater collateral or higher financing costs), policy makers should address ways in which either public guarantees or joint partnerships with external financing partners allow the

creation of diversified funding market which is accessible for broader set of SMEs. This commitment towards SME sector by governmental agencies will help external financiers and international capital providers to recognise the importance and long-term commitment of public institutions to support innovative SMEs within Poland and Czech Republic.

Furthermore, one aspect that was consistent throughout this thesis is the need for policy makers to strengthen the knowledge creation and knowledge sharing among SMEs in Poland and Czech Republic. As in terms of diversity of financing, collaboration activities along supply chain, but also regarding challenges and enablers to innovation, policy makers should more frequently communicate and play an advisory role to SMEs to recommend new trends (e.g. promote diversity of finance sources) and highlight concerns about areas that may impact innovation (e.g. relational over-embeddedness in certain associations, etc). In doing so, policy makers should place an emphasis on strengthening the new knowledge creation in focus areas that will address the needs of Polish and Czech economies. For instance, Paper Two addressed the need for enhanced policy efforts to stimulate inter-firm collaboration, where both Polish and Czech SMEs lag against European peers (European Commission, 2018a). Policy support is required to stimulate growth of pilot programmes that require inter-firm collaboration for new product developments, experimentation and exchange of knowledge. In addition, governmental programmes to support SME managers in areas such as enhancement of effective communication with collaborative partners will be crucial to overcome certain social and cultural barriers among Polish and Czech SMEs which will now require a move towards a more trust based, mutually supportive and open collaboration supported by exchange of information.

While both Paper Two and Three recognise the importance of collaboration to support innovative activities, the policy makers should recognise two additional aspects we discovered in this thesis. Firstly, the over-engagement in intense buyer co-operation relationships may lead to diminishing returns in product innovation. From policy perspective it is relevant as governmental institutions and policy makers more frequently recognise the importance of collaboration, however the usual content of recommendations is quite generic, thus lacks clear actionable suggestions for firms to shape their collaborative arrangements. As policy makers issue recommendations to SMEs, limited attention is placed on *intensity* or *breadth* of associations between firms. In line with the results of this thesis, the policy makers should not only reference the two concepts once they publish recommendations, but also discuss areas where nonlinear relationships may affect innovation (i.e. over-engagement

in intense buyer relationships). Especially, as the focus of policy makers is to strengthen the collaboration along supply chain, more context should be provided for firms to understand what intensity or breadth of associations can mean for their innovations. Secondly, as noted in Paper Three, collaboration was recognised as innovation enabler by high innovation capability firms. The results of this study expand on Brandt (2018) recommendations published by OECD and this thesis suggests governmental subsidies should be linked to the degree of inter-firm co-operation with industry as well as with research institutions. Formalising the inter-firm collaboration and aligning it to the degree (or strength) of such co-operation would strengthen both Polish and Czech SMEs to expand their existing network of partners but also to intensify certain relationships. Finally, linking with Paper One, this thesis also suggests policy makers should focus on establishing innovation supporting R&D programmes which combine private investments into R&D as well public or EU funds. In doing so, joint R&D programmes will be more effective (and likely more cost attractive due to risk sharing principle) for new funding providers to engage in new financing ventures as they recognise governmental or public institutions are also in support of the investment. This policy may strengthen the SME finance market and allow for more diversity in finance offering at the same time supporting the commercial result of the R&D activity.

The relative high share of micro firms in the sample provides further insights into practical and policy related considerations. From the managerial perspective, micro firms' managers should be aware of the funding diversification effects on innovation activities. Increasing the access to external sources of financing and ability of a micro firm to tap into a broader set of financing options will positively influence new product and process innovations. However, beyond certain point, over diversification may lead to diminishing returns in product innovation which in some cases may relate to reducing autonomy of owner-managers to purse certain innovative ideas during various stages of financing. In collaborating arrangements, micro firm managers should be aware of diminishing returns from over-intensive buyer associations. In a micro firm setting such situation may occur due to a limited ability to absorb and exploit the contextual knowledge from such arrangements as information overload may restrict micro firm's ability to commercialise on the most relevant new product development. In the public policy debate, more discussion should be placed on creating environments to ease the access for financing towards micro firms and reduction of their reliance on debt financing. With more public policy support in expanding financing options (in the context of control rights transfer), micro firms may embrace benefits from

funding diversification which will positively impact their product and process innovations. In the context of support in micro firms' collaboration, public policies should address and support partnership arrangements between suppliers and buyers, create environments for them to engage and exchange information but also raise awareness of the impacts of certain over-intensive associations to improve the cognitive and contextual knowledge absorption of micro enterprises.

Lastly, certain evidence of management attitudes found in this thesis (e.g. "*we don't need more innovation*") should be addressed by both policy makers and firm's management. Policy makers should build more contextual knowledge among Polish and Czech SMEs to share perspectives on new innovative trends through governmental knowledge sharing platforms that discuss innovation at European and global level so that SMEs are supported in building a "*bigger picture*" that will enhance their innovative aspirations and help to expand their opportunities (e.g. by support in co-operative activities). In addition, managers role is to broaden the access to knowledge (e.g. via intensifying collaborative arrangements) if the focus is to move from transactional (supplier – buyer relationship) to more value added, knowledge generating, innovation-based co-operation. While an in-depth discussion of various SME managerial strategies and they relation to innovation is outside of the scope of this study, the issue points towards interesting areas for new research discussed in more details in Section 6.6.1.

## 6.4. Notable differences between Polish and Czech SMEs

As this thesis discusses influences on innovation among Polish and Czech SMEs, it is worth exploring some notable country specific differences in the results of this study. Starting with *diversified funding base*, the results herein demonstrate significant differences in process innovation between Polish and Czech firms. Polish firms show significantly lower values for process innovations than their Czech counterparts. These results are consistent with findings from Paper Two where for *intensity* of co-operative activities in process innovations, Polish firms showed significantly lower values than Czech firms. There could be two reasons for these results. First, some scholars suggest (e.g. Mizgajska, 2009) that Polish SMEs are more frequently inclined to pursue product innovations to establish an advantageous position on the competitive domestic market; though we believe same approach is intrinsically important for Czech firms. Second, proximity to Germany and

Austria was noted as a supporting factor for Czech firms to become a leading recipient of foreign direct investments which in effect allow to focus on improvements in production processes (Pavlinek and Smith, 1998). While differences in levels of process innovations have been recognised in this thesis, future studies should explore more influences and drivers for process innovation between Polish and Czech firms.

Moreover, the results of supply chain collaboration discussion in Paper Two also point towards some nuanced relationship between country specific factors and buyer / supplier co-operation. In average, the country specific influence of Polish firms on the impact of buyer co-operation on product innovation is lower than for the Czech firms. This is relevant, as the results herein noted a curvilinear relationship for buyer relationships on product innovation and future studies should explore the specifics of Polish and Czech firms' characteristics that may influence the direction of this relationship. On the other side, the Polish firms' influence on the relationship between supplier co-operation and product innovation is greater than for Czech firms. While we treat these results with caution (see Section 4.4.3.3) future studies could emerge in analysing areas of *preferred* direction of supply chain embeddedness for Polish and Czech firms and their likely impact on innovation (see Section 6.6.1 for more details in relation to new areas of research).

Furthermore, the discussion of challenges and enablers to innovation (Paper Three) noted some further interesting differences between Polish and Czech firms. For example, Polish SMEs more frequently face decisions whether to support R&D activities or use funds for alternative (non-R&D) initiatives. This challenge is not surprising as Polish firms frequently finance innovation from their own funds, thus trade-offs between R&D or alternative investments (non-R&D) will be significant in the condition of capital scarcity. This builds well on the earlier discussion of the need for policy makers to enable *funding diversification* options for SMEs which in effect will contribute to the reduction in trade-off decisions that eventually hamper innovation. In addition, the self-perception ("*we don't need more innovation*") is more often present among Polish SMEs. As noted earlier, knowledge enhancement, knowledge sharing (e.g. via collaborative arrangements, working groups, etc.) and greater external awareness will address the issue related to this self-perception, however a more increased understanding of this issue is needed from both policy and managerial perspective.

Lastly, although Polish firms recognised the self-perception challenge ("*we don't need more innovation*"), they also noted the importance of certain enablers more frequently than their Czech counterparts. For instance, Polish firms demonstrated the importance of trainings, review of organisational structures, co-operation and participation in external conferences as activities which will likely support innovation. While Polish firms recognised certain challenges and enablers more often than their Czech counterparts, the activities and response strategies towards management attitudes and corporate innovation strategy will be relevant to understand whether Polish firms could take advantage of the awareness in driving sustainable innovations. This leads to a potential area for further research also discussed in the later Section 6.6.1.

## 6.5. Hindsight and resolving limitations

While the research thesis has accomplished its goals, it is fair to recognise certain limitations which are inevitably present across all research studies. The final survey itself has generated number of ideas that can be incorporated in the new study. The recommendations include incorporation of certain new questions to: 1) explore funding diversity concept in more details by recognising new alternative ways firms access financing or focus on share of various financing methods; 2) explore details of various management strategies and a broader set of challenges and enablers to innovation; 3) details of collaborative associations to recognise a more granular understanding of the nature within up and downstream relationships. However, some questions may be removed to ensure new survey is not burdened with numerous unnecessary questions and hence less time consuming. Additionally, some questions (e.g. share of financing) could be amended to ensure that individual firm responses always tally back to 100%. In addition, industry categorisation used in this research (following Klonowski, 2012) has not captured sufficient breadth as number of firms preferred to be categorised in "other" category, thus future study should ensure a broader set of industrial and servicing sectors to recognise the diversity of the SME market. Additionally, greater emphasis could be given to the exploration of financing activities of SMEs, perhaps dedicating a whole new survey towards this subject, to fully account for the current ways firm access financing but also, barriers to financing and inclination to diversification of funding sources. This could lead to new areas of research which could address potential trade-offs between certain funding instruments and discuss resultant impact on innovation. Furthermore, with the growing digitisation of SME segment, a potential new set of questions (or even new survey) could emerge to capture innovation within digital environment, a segment demonstrating significant growth in recent years. This could lead to new insights which likely re-define the traditional way of perceiving innovation by certain SMEs.

Besides the changes to the survey a potential combination of interviews (e.g. multi-point survey) would enhance understanding of the responses and gather new context for the answers given. In addition, to account for game-theoretic trade-off considerations between various funding instruments in a future study, a focus group of SMEs could provide a useful mechanism to collect insights to complement the traditional survey. Especially in the context

of game-theoretic analysis gathering insights from a series of interviews might be more feasible to account for respondent motivations for certain funding trade-off decisions.

Lastly, while a rich dataset of 321 responses was collected (of which 282 Polish and 39 Czech SMEs), further development of SME database would be necessary to achieve a higher volume of responses. Especially in the context of Czech data, additional measures will likely be required to increase the number of valid responses in future studies. Additionally, likely more responses would have been gathered with the support of Polish and Czech Chambers of Commerce that may aid with access to the Polish and Czech SME databases during the future studies. Furthermore, in terms of SME segmentation, more than 46% of all respondents belonged to a micro segment (i.e. less than 10 employees) and futures studies should ensure a more equal distribution between micro, small and medium enterprises to support the generalisability of the results.

## 6.6. Future directions for research

### 6.6.1. New research

Future research should expand on the findings from this thesis, build on theoretical, practical and policy recommendations and incorporate lessons learned as discussed in earlier Section 6.5. Throughout of this study number of areas have emerged that deserve a new research investigation and the discussion in this section will address each of them individually.

Starting with Paper One potential avenue for research could build on entrepreneur's decisions between specific finance instruments and provide more insights into trade-offs or game theoretical considerations. It would be interesting to observe, in game theoretical setting, the rationale for managers to embrace certain finance means and the resultant impact on innovation. The game theory literature in innovation has attracted significant attention over the past years, however the aspects of trade-offs between various finance sources has not yet found sufficient debate. Thus, the new research could assume two potential scenarios. In the first one, managers would be constrained in terms of few financial instruments available and make decisions recognising scarcity of resources. In the second scenario, entrepreneurs will be provided with a hypothetical situation in which scarcity of resources does not exist and financial instruments are freely accessible in their markets. Hence, the

latter model would assess manager's decisions in the absence of financial constraints but could help investigate diversification decisions based on financing costs or reduction in owner-manager's autonomy when embracing certain financing mix. Assessing both scenarios in a game-theoretic setting would help understanding entrepreneurs' rationale between each financial choice in situations when financial access constraints either exist or are overcome. To make the research manageable and realistic for firms, the new study could also assume a certain degree of firm's leverage and then introduce a game-theoretic consideration. With few groups of firms being different in terms of leverage, the new research could build on the findings from this thesis and expand on firm's capital structure debate and entrepreneur's decisions for funding diversification dependent on varying level of leverage.

Another potential area for new research could broaden the construct of *diversified funding base*. For instance, the current construct assesses both accessibility and dependency on funding instruments and future modifications of the construct could also provide for the *breadth* (i.e. number) of the financing instruments used by a firm. By recognising the number of instruments used, new research could use multivariate analysis to derive an *optimal* number of financial instruments that most effectively support innovation. While this could have a limitation that not only the number but also its financial cost and volume of financing are relevant, the enhancement of the new study could introduce a *weighted number* of financial instruments used (i.e. volume of instruments weighted by its value, costs, or importance for decision autonomy, to assess the relative significance of each of the financing instrument). Future studies could also explore *share of financing* between various finance instruments and its impact on innovation. In doing so, while properly accounting for share or weighted share of financing, the new research could explore the *strength* (i.e. intensity) of dependence towards certain financing instrument and hence its relative impact on innovation. However, with the share of financing, as discussed earlier, the new research should ensure the total volume of financing within a firm is equal to 100% so that the study does not over-assesses the impact of certain instruments. Potentially, the new study could also survey a smaller group of firms (e.g. 50-100) using traditional questionnaire but complement it with focused groups and informed interviews to ensure context of the answers is well captured within each response. Recognising the *funding diversity* of a firm is a complex exercise, thus properly capturing inputs (e.g. either via the *breadth* or *strength* related to higher relative share of financing) will be crucial to assess its impact on innovation.

Building on the curvilinear relationships in funding diversification found in this research, the new study could expand on the optimal level of funding diversification for certain group of firms, either categorising them by firm size, industry or degree of leverage. Enhancing our understanding of relational embeddedness in funding diversity will help managers and policy makers to tailor more focused strategies and policy papers to introduce tools to either monitor the funding diversification level of the SME segments or to promote and incentivise additional funding providers to enter the market. As international and national agencies (e.g. OECD 2015a) start to recognise funding diversification as a new area of attention within studies of innovation, this research thesis has served as a foundation for future exploration in this field.

Relational embeddedness was also a topic of Paper Two of this research and new study could expand on entrepreneur's decisions to embed into certain supply chain arrangements. For instance, buyer co-operation on product innovation exhibited non-linear characteristics in this research thesis. Future study could build on these results and investigate what specific downstream associations contribute to the diminishing returns in innovation. For instance, by recognising different and granular nature of activities within buyer-relationships (i.e. different character of engagement with buyers), the new study could explore specific actions that contribute to the curvilinear results and thus introduce recommendations to moderate the effects. Furthermore, as SMEs in Polish and Czech context focus on internalisation of their activities, future studies could differentiate the domestic and international character of their co-operations along the supply chain. This study could complement the insights provided in this research and provide for more granular and specific recommendations if firm's strategy is focused on domestic, international or mixed (domestic and foreign) collaborations.

Moreover, the findings from Paper Three (e.g. observation of "*we don't need more innovation*") could represent an area for future studies that investigate various management strategies and their impact on innovation. Building on this idea, future study could explore manager's reluctance and willingness to innovation and contrast it with various SME managerial strategies. This will enhance our understanding of managerial attitudes that impact innovation but also help to derive more insights from certain reluctance to innovation as presented in this research thesis. Furthermore, future studies could expand on the challenges and enablers to innovation listed in this research and provide for more granular list of obstacles and enablers. Going a step further, new research could investigate the "*why"*

each firm decided to name certain challenges and enablers. In doing so, the new study could go a level deeper in understanding insights and perceptions and hence provide for more tailored and specific managerial and policy recommendations.

Lastly, with the growing field of internet focused and digitally oriented SMEs (often operating within digital distribution channels only), the new studies could emerge and explore areas of innovation within digital context. With digital SMEs likely exhibiting different attitude towards innovation and constant adaptability to a rapidly changing digital environment, new research could provide more insights into innovation of start-ups and online ventures, critically assessing the concept of incremental change and new radical innovations within digital environment. This research would require a very robust online survey that is tailored to digital savvy SMEs and collect responses related to three interconnected topics of this study (access to financing, collaboration, challenges and enablers to innovation). This analysis would build on the results of this research and expand to the sector of digital SMEs to provide a broader picture for the three topics analysed in this study. Furthermore, with the dynamic growth of the sector, the new research could contribute to the literature of SME innovation and provide some policy recommendations to institutions focused on supporting the growth of digital economies, an area that is increasingly more important for policy makers across Europe and beyond.

As presented above, the opportunities to expand on the foundations built in this study are vast and areas suggested above will deepen our understanding of the three interconnected research topics discussed in this thesis.

## 6.7. Chapter Summary

This section has brought all the findings together and discussed theoretical, managerial and policy recommendations. In addition, building a link to the rationale for each paper introduced earlier (Section 1.4), this chapter demonstrated that the objectives of the thesis have been achieved. This section also discussed thesis limitations and suggested further areas of research that will allow to expand on the findings from the discussed three papers. The final section below discusses final remarks and brings the thesis to an end with final conclusions.

# 7. Conclusion and Final Remarks

Innovation is key to achieve and sustain growth. It is even more relevant for markets in CEE economies where catching up with more developed markets requires continued and intensified innovation (World Bank, 2016). While there have been numerous studies investigating influences on innovation, there are still areas which have attracted limited research attention. This research thesis has undertaken a study to investigate new concepts affecting innovation in CEE economies. Using unique set of survey data from Polish and Czech SMEs, this thesis adds an empirical evidence to innovation literature and introduces new aspects in which to assess innovation supporting strategies. As a result, three independent papers have been developed, each providing unique set of theoretical, managerial and policy recommendations which have been brought together into this coherent research thesis.

Ultimately, this thesis has demonstrated number of dynamic relationships that influence SME innovation in CEE economies. Entrepreneur's decisions to embed in certain collaborative arrangements or choices to embrace a certain financing strategy may impact firm's innovative performance. This compounded with manager's perception of external and internal environment, together with its challenges and enablers to innovation, poses a complex area of connected factors that influence innovation. As innovation becomes a cornerstone of management strategies, entrepreneurs will more frequently be faced with optimisation decisions related to one or all the three topics discussed in this study. Recognising the effects of certain decisions will allow entrepreneurs to take more informed decisions and policy makers to set the right agenda to support SME managers in their pursuit for new innovations. By highlighting new potential influences on innovation and introducing new metrics such as *funding diversification* this thesis has taken an innovative and challenging approach to discovering a new set of dynamics within SME finance and innovation studies. In doing so, it has highlighted number of conclusions, managers and policy recommendations but also new areas of research that can build on the results of this study. Finally, this research thesis provided insights into firms from Poland and Czech Republic, thus can serve as a foundation for future studies in these countries in the field of funding diversification, supply chain collaboration, challenges and enablers to innovation.

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While each paper contains its own list of references at the end of each paper, the reference list below relates to this document alone.


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# Appendix 1: Survey (English Translation)

## SECTION 1 – About your company

We would like to begin by asking you some general questions about your firm, its structure and its location before considering its strategic influences.

**1. When was your company established?** *Source Laforet (2013)*

please provide the date: ...

**2. What is the ownership structure of your firm (Please tick one box)**

*Source (Ortega-Argilés et al., 2005, Laforet, 2013)*

□ Family owned company

□ Sole Trader

□ Franchise

□ Subsidiary of foreign-owned company

□ Partnership

□ Other

**3. What sector does your firm belong to?**

*Source (Klonowski, 2012)*

□ Production

□ Construction

□ Retail and wholesale

□ Hotels and restaurants

□ Transport

□ Telecommunications

□ Financial Services

□ Health

□ Other

**4. What is the percentage ownership of the main owner in your company?**

*Source (Ortega-Argilés et al., 2005)*

□ < 25%

□ 25-50%

□ 50

□ 50 - 75%

□ 75 - 100%

□ 100%

**5. How many employees in total are in your company? (Please tick one box)**

*Source Yam et al. (2011)*

□ Fewer than 10 employees

□ 10-49 employees

□ 50-99 employees

□ 100-149 employees

□ 150 - 199 employees

□ 200 - 250 employees

□ greater than 250 employees

**6. What factors have influence on the results of your company?**

**Small impact** → **High Impact**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Product innovation | | | | | | | |
| Process Innovation | | | | | | | |
| Competition | | | | | | | |
| Market expansion | | | | | | | |
| New Distribution channels | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cooperation with other companies | | | | | | | |
| Marketing | | | | | | | |
| Access to financing | | | | | | | |

**7. How would you describe the activities of your company?**

□ Service provider for larger enterprises (e.g. shared service centre)

□ Subcontractor (supplier of products to bigger enterprises)

□ Niche player (providing products which are economically not attractive to bigger companies)

□ Innovator (market leader in products which require high human capital investment)

## SECTION 2

### Your Firm's Research and Development activities

**8. Approximately, what proportion of your firm's turnover (either direct budget or staff time) was spent on Research and Development activities (e.g. Product, Process, or Design activities conducted either in-house or in collaboration) over the last five years? (Please tick one)**

□ 0% □ 1-5% □ 6-10% □ 11-20% □ 21-30% □ Greater than 30%

*Source: Cohen and Levinthal (1990), Branston and Tomlinson (2013) – Survey on UK ceramic industry,*

**9. What supports the innovation most at your company?**

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| Strong co-operating with suppliers | | | | | | | |
| Strong co-operating with buyers | | | | | | | |
| International cooperation with suppliers | | | | | | | |
| International cooperation with buyers | | | | | | | |
| Diversified funding base (more than 3 sources) | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Employee education | | | | | | | |
| More than 50% share of main owner | | | | | | | |
| Access to governmental subsidy financing | | | | | | | |
| Access to commercial funding (e.g. banks) | | | | | | | |
| Access to Venture Capital Funding | | | | | | | |

**10. Approximately, what is the educational level of your staff? Please tick which applies.**

*Source Romijn and Albaladejo, (2002)*

| | | | | | |
|---|---|---|---|---|---|
| Without degree | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Greater than 30% |
| With High School diploma | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Greater than 30% |
| With university degree | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Greater than 30% |
| With higher degree (PhD, MBA, etc.) | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Greater than 30% |

**11. Please indicate on the following scale the extent to which your firm has introduced NEW PRODUCT LINES, altered EXISTING PRODUCTS and made changes in its PRODUCTION PROCESSES over the last five years. (SCALE 1 -7, i.e. 1 = None, 2 = Low Level…and 7 = A Great Many etc).**

Source Branston & Tomlinson (2013) Survey from UK ceramics industry

**Low level** → **High level**

| | None 1 | 2 | 3 | 4 | 5 | 6 | A great many 7 |
|---|---|---|---|---|---|---|---|
| Number of new products introduced | □ | □ | □ | □ | □ | □ | □ |
| Number of changes/improvements to existing products | □ | □ | □ | □ | □ | □ | □ |
| Number of new equipment/technology introduced in the production process | □ | □ | □ | □ | □ | □ | □ |
| New input materials introduced in the production process | □ | □ | □ | □ | □ | □ | □ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of organisational changes/improvements made in the production processes | □ | □ | □ | □ | □ | □ | □ |

## 12. Please answer the following questions

Source Branston & Tomlinson (2013) Survey from UK ceramics industry

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| We are often the first company to introduce innovative products, new services and technologies | | | | | | | |
| We spend more heavily on Research and Development than our competitors | | | | | | | |
| We consider our company highly competitive due to aggressive pricing strategies | | | | | | | |
| We bring to the market more new products than our main competitors | | | | | | | |

## 13. How do you support the innovation in your company?

| | 1 – Never | 2 – Rarely (in less than 10% of cases) | 3- Occasionally (in about 30% of cases) | 4-sometimes (in about 50% of cases) | 5-frequently (in about 70% of cases) | 6-usually (in about 90% of cases) | 7-every time |
|---|---|---|---|---|---|---|---|
| Through trainings, seminars | | | | | | | |
| Through governmental subsidies to enhance innovative ideas | | | | | | | |
| Through regular working | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| groups with the objective to improve the processes | | | | | | | |
| Through continual review of organisational structure | | | | | | | |
| Through participation in conferences, working panels | | | | | | | |
| Through co-operation with other companies | | | | | | | |

**14. What were the most difficult challenges in the introduction of innovative ideas/products in your company?**

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| Regulatory issues when patents are registered | | | | | | | |
| High costs of R&D investments | | | | | | | |
| Uncertainty in respect to the outcome of the innovation | | | | | | | |
| Other alternative ways of spending free cash rather than for R&D investments | | | | | | | |
| Introduction of new distribution channels | | | | | | | |
| My company's business does not require increase in innovation | | | | | | | |

## SECTION 3 – Your Firm's sources of financing

In this section, we would like to explore how your firm gets access to the financing.

**15. Which sources of financing is your firm most dependent on?**

| | 1 – Never | 2 – Rarely (in less than 10% of cases) | 3- Occasionally (in about 30% of cases) | 4-sometimes (in about 50% of cases) | 5-frequently (in about 70% of cases) | 6-usually (in about 90% of cases) | 7-every time |
|---|---|---|---|---|---|---|---|
| Debt financing from the commercial banks | | | | | | | |
| Funding from governmental agencies | | | | | | | |
| Venture capital financing | | | | | | | |
| Equity financing | | | | | | | |
| Other please specify: | | | | | | | |

**16. What is the share of financing between different financing methods of your company?**

*Source (Ortega-Argilés et al., 2005)*

| | 0%-10% | 10%-30% | 30%-50% | 50%-70% | 70%-100% |
|---|---|---|---|---|---|
| Debt financing from the commercial banks | □ | □ | □ | □ | □ |
| Funding from governmental agencies | □ | □ | □ | □ | □ |
| Venture Capital financing | □ | □ | □ | □ | □ |
| Equity financing | □ | □ | □ | □ | □ |
| Other please specify: | □ | □ | □ | □ | □ |

**17. What is the purpose of your financing?**

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| Financing of short term activities | | | | | | | |
| Financing of the launch of new products | | | | | | | |
| Financing the purchase of new infrastructure | | | | | | | |
| R&D financing | | | | | | | |
| Financing other innovations | | | | | | | |
| Other please specify: | | | | | | | |

**18. Which financing methods are most effective to support innovation in your company?**

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| Equity financing | | | | | | | |
| Debt financing | | | | | | | |
| Venture Capital financing | | | | | | | |
| Governmental financing | | | | | | | |
| Stock issuance | | | | | | | |
| Other please specify: | | | | | | | |

**19. What impacts your decision on how you finance innovation in your firm?**

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| Accessibility of external debt finance from commercial banks | | | | | | | |
| Accessibility of governmental subsidised financing | | | | | | | |
| Available equity | | | | | | | |
| Trust and empathy to my current financiers | | | | | | | |
| Accessibility of venture capital investors | | | | | | | |
| Other please specify: | | | | | | | |

**20. In case you used venture capital finance, what was the impact on your innovation capability?**

*Source: Engel and Keilbach (2007)*

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Innovation remained at the same level | | | | | | | |
| Innovation decreased | | | | | | | |
| Innovation increased | | | | | | | |
| Venture capitalist did not support the innovation | | | | | | | |
| Venture capitalist focused on commercialisation of existing innovations in the company | | | | | | | |
| Other please specify: | | | | | | | |

## SECTION 4 – Your Firm's degree of co-operation with other companies

**21. With how many suppliers do you co-operate (either information or experience exchange?**

*Source: Gebreeyesus and Mohnen (2013)*

| | 0-5 | 6-10 | 11-15 | 16-20 | 21-30 | > 30 |
|---|---|---|---|---|---|---|
| Please tick the number | □ | □ | □ | □ | □ | □ |

**22. With how many buyers do you co-operate? (either information or experience exchange?**

*Source: Gebreeyesus and Mohnen (2013)*

| | 0-5 | 6-10 | 11-15 | 16-20 | 21-30 | > 30 |
|---|---|---|---|---|---|---|
| Please tick the number | □ | □ | □ | □ | □ | □ |

**23. What proportion of your firm's sales turnover came from sales to your main buyer? (Please tick one box)**

□ 0-25% □ 26-50% □ 51-75% □ 76-100%

**24. What proportion of your firm's sales turnover came from sales to international buyers? (Please tick one box)**

□ 0-25% □ 26-50% □ 51-75% □ 76-100%

**25. What is the scope of your co-operation?**

*Source: Tomlinson and Fai (2013)*

| | 1 – Never | 2 – Rarely (in less than 10% of cases) | 3- Occasionally (in about 30% of cases) | 4- sometimes (in about 50% of cases) | 5-frequently (in about 70% of cases) | 6-usually (in about 90% of cases) | 7-every time |
|---|---|---|---|---|---|---|---|
| Improving Product quality | | | | | | | |
| New Product designs | | | | | | | |
| Exchange of information/experiences | | | | | | | |
| Marketing and Distribution of products | | | | | | | |
| Production organisation | | | | | | | |
| Technological upgrading | | | | | | | |

**26. When co-operating with your suppliers what is the most important to your firm?**

*Source: Tomlinson and Fai (2013)*

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| Improving quality of inputs | | | | | | | |
| Exchange of information/experiences | | | | | | | |
| Improving delivery times | | | | | | | |
| Labour training | | | | | | | |
| Production organisation | | | | | | | |
| Technological upgrading | | | | | | | |

**27. How strong do you co-operate with suppliers**

*Source: Knorringa (1999), Tomlinson and Fai (2013)*

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| I limit my co-operation to only few core suppliers | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| I try to have many suppliers | | | | | | | |
| I often search for new international partners | | | | | | | |
| I prefer to have longer and stable co-operative relationship with my suppliers | | | | | | | |
| I prefer to have large number of different suppliers without long-term commitment | | | | | | | |

**28. How strong do you co-operate with buyers**

*Source: Knorringa (1999), Tomlinson and Fai (2013)*

| | 1 – strongly disagree | 2 – disagree | 3-somewhat disagree | 4-neutral | 5-somewhat agree | 6-agree | 7-strongly agree |
|---|---|---|---|---|---|---|---|
| I limit my co-operation to only few core buyer | | | | | | | |
| I try to have many buyers | | | | | | | |
| I often search for new international partners | | | | | | | |
| I prefer to have longer and stable co-operative relationship with my buyers | | | | | | | |
| I prefer to have large number of different buyers without long-term commitment | | | | | | | |

**29. What is the degree of your co-operation?**

*Source: Knorringa (1999), Tomlinson and Fai (2013)*

**Low level** → **High level**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Between your firm and firms from the same industry *(horizontal co-operation)* | | | | | | | |
| Between your firm and firms from your supply chain *(vertical co-operation* | | | | | | | |

## SECTION 5

### About You

Finally, we would like to ask you some general questions about yourself.

**30. What is your current job title? _____**

**31. Approximately, how many years have you been working in the industry? _____**

Thank you for taking the time to complete this questionnaire. Your responses will be treated in the strictest of confidence and all findings will be aggregated ensuring that no company or individual can be identified in any way.

# Appendix 2: Survey (Polish Translation)

**TEMAT: Czynniki wpływające na innowacyjność małych i średnich przedsiębiorstw w Polsce i Republice Czeskiej**

Ankieta ma na celu zbadanie czynników, które wpływają na zdolność innowacji w małych i średnich przedsiębiorstwach (MŚP) w Europie Środkowej i Wschodniej na przykładzie Polski i Czech. Badanie to ma na celu określenia powiązań różnych czynników, takich jak wybór metod finansowania, struktury własnościowej i powiązań kooperacyjnych na innowacyjność małych i średnich przedsiębiorstw w Polsce i Republice Czeskiej.

Wyniki badań powinny dać odpowiedź na temat metod, które mają największy wpływ na innowacje w małych i średnich przedsiębiorstwach w Polsce i Republice Czeskiej.

……

**Instrukcje wypełniania**

Kwestionariusz powinien być wypełniony przez osoby kierujące przedsiębiorstwem (np. dyrektor zarządzający / Manager). Ponieważ nasze badanie obejmują różne zagadnienia działalności firmy, prosimy zaznaczyć odpowiednie pole lub dopisać odpowiedź ręczenie. Interesuje nas wszystkie odpowiedzi więc prosimy przesłać ankietę, nawet jeśli nie jest w pełni ukończona. Badania będą analizowane w ścisłej tajemnicy i tylko zagregowane wyniki zostaną przedstawione w końcowej pracy doktorskiej. Poglądy osób lub firm, nie będą udostępnione. Wypełnienie ankiety zajmie około 15 minut.

## ROZDZIAŁ 1 - O Twojej firmie

Chcielibyśmy rozpocząć zadając kilka ogólnych pytań dotyczących Twojej firmy.

**1. Kiedy firma została założona?**

proszę podać datę: ...

**2. Jaka jest struktura własności Twojej firmy (Proszę zaznaczyć jedną odpowiedź)**

□ spółka rodzinna
□ spółka jednoosobowa
□ franczyza
□ spółka zależna od spółki z udziałem kapitału zagranicznego
□ partnerstwo
□ inne, proszę podaj:…..

**3. Do jakiej branży należy Twoja firma?**

□ Produkcja
□ Budownictwo
□ Sprzedaż detaliczna i hurtowa
□ Hotele i restauracje
□ Transport
□ Telekomunikacja
□ Usługi finansowe
□ Usługi medyczne
□ Inne, proszę podaj:….

**4. Jaki jest odsetek własności głównego właściciela w Twojej firmie?**

□ <25%
□ 25-50%
□ 50
□ 50 - 75%
□ 75 - 100%
□ 100%

**5. Ilu pracowników jest zatrudnionych w Twojej firmie? (Proszę zaznaczyć jedną odpowiedź)**

□ Mniej niż 10 pracowników
□ 10-49 pracowników
□ 50-99 pracowników
□ 100-149 pracowników
□ 150 - 199 pracowników
□ 200 - 250 pracowników
□ więcej niż 250 pracowników

**6. Jakie czynniki mają wpływ na wyniki Twojej firmy?**

**Mały wpływ** ⟶ **Duży wpływ**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Innowacyjność produktu | | | | | | | |
| Innowacyjność procesów | | | | | | | |
| Konkurencja | | | | | | | |
| Ekspansja rynku | | | | | | | |
| Nowe kanały dystrybucji | | | | | | | |
| Współpraca z innymi firmami | | | | | | | |
| Marketing | | | | | | | |
| Dostęp do finansowania | | | | | | | |

**7. Jak można opisać działalność Twojej firmy?**

□ Usługodawca dla dużych przedsiębiorstw (np. wspólne centrum usług)
□ Podwykonawca (np. dostawca produktów do dużych przedsiębiorstw)
□ Niszową (np. dostarczanie produktów, które nie są ekonomicznie atrakcyjne dla większych firm)
□ Innowacyjna (np. lider na rynku produktów, które wymagają dużych inwestycji, kapitału ludzkiego)

## ROZDZIAŁ 2 – Nakłady na Badania i Rozwój

**8. W przybliżeniu, jaką część obrotów Twojej firmy (bądź budżetu lub czasu) przeznaczono na badania i rozwoju (np. produktu, procesu lub projektu) w ciągu ostatnich pięciu lat? (Proszę zaznaczyć jedną)**

□ 0% □ 1-5% □ 6-10% □ 11-20% □ 21-30% □ Więcej niż 30%

**9. Co najbardziej wspiera innowacje w Twojej firmie?**

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Silna współpraca z dostawcami | | | | | | | |
| Silna współpraca z nabywcami | | | | | | | |
| Międzynarodowa współpraca z dostawcami | | | | | | | |
| Międzynarodowa współpraca z nabywcami | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Zróżnicowana baza finansowania (tj. więcej niż 3 źródła finansowania) | | | | | | | |
| Edukacja personelu | | | | | | | |
| Więcej niż 50% udziałów w rękach głównego właściciela | | | | | | | |
| Dostęp do finansowania rządowego | | | | | | | |
| Dostęp do komercyjnych źródeł finansowania (np. z banku) | | | | | | | |
| Dostęp do finansowania kapitału podwyższonego ryzyka (tj. Venture Capital) | | | | | | | |

**10. W przybliżeniu, jaki jest poziom wykształcenia Twoich pracowników?**

| | | | | | |
|---|---|---|---|---|---|
| Wykształcenie podstawowe | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Więcej niż 30% |
| Wykształcenie średnie | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Więcej niż 30% |
| Wykształcenie wyższe | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Więcej niż 30% |
| Wykształcenie podyplomowe (Dr, MBA, itp.) | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Więcej niż 30% |

**11. Proszę wskazać na poniższej skali, w jakim stopniu Twoja firma wprowadziła nowe linie produktów, zmiany istniejących produktów i dokonała zmian w swoich procesach produkcyjnych na przestrzeni ostatnich pięciu lat. (SKALA 1 -7, czyli 1 = Brak, 7 = bardzo wiele, itd.).**

**Niski poziom → Wysoki poziom**

| | Brak 1 | 2 | 3 | 4 | 5 | 6 | Bardzo Wiele 7 |
|---|---|---|---|---|---|---|---|
| Liczba nowych produktów wprowadzanych | □ | □ | □ | □ | □ | □ | □ |
| Liczba zmian / ulepszeń do istniejących produktów, | □ | □ | □ | □ | □ | □ | □ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Liczba nowych urządzeń / technologii wprowadzonego w procesie produkcji | □ | □ | □ | □ | □ | □ | □ |
| Nowe materiały wejściowe wprowadzane w procesie produkcji | □ | □ | □ | □ | □ | □ | □ |
| Liczba organizacyjnych zmian / ulepszeń w procesach produkcyjnych | □ | □ | □ | □ | □ | □ | □ |

**12. Proszę odpowiedzieć na poniższe pytania**

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Często jesteśmy pierwszą firmą, która wprowadza innowacyjne produkty, nowe usługi i technologie | | | | | | | |
| Przeznaczamy więcej środków na badania i rozwój niż konkurencja | | | | | | | |
| Uważamy, że nasza firma jest bardzo konkurencyjna ze względu na agresywne strategie cenowe | | | | | | | |
| Wprowadzamy na rynek więcej nowych produktów niż u naszych głównych konkurentów | | | | | | | |

## 13. Jak wspierasz innowacje w Twojej firmie?

| | 1 - nigdy | 2 - rzadko (u mniej niż 10% przypadków) | 3- Sporadycznie (w około 30% przypadków) | 4-czasem (w około 50% przypadków) | 5-często (w około 70% przypadków) | 6 - na ogół (w około 90% przypadków) | 7-zawsze |
|---|---|---|---|---|---|---|---|
| Poprzez szkolenia, seminaria | | | | | | | |
| Dzięki dotacjom rządowym w celu zwiększenia innowacyjności | | | | | | | |
| Poprzez regularne grupy robocze w celu dokonania poprawy procesów | | | | | | | |
| Poprzez ciągły przegląd struktury organizacyjnej | | | | | | | |
| Poprzez udział w konferencjach, panelach roboczych | | | | | | | |
| Poprzez współpracę z innymi firmami | | | | | | | |

## 14. Jakie były najtrudniejsze wyzwania wprowadzenia innowacyjnych pomysłów / produktów w Twojej firmie?

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Kwestie prawne (np. związane z patentami) | | | | | | | |
| Wysokie koszty inwestycji w badania i rozwój | | | | | | | |
| Niepewność w odniesieniu do wyników innowacyjności | | | | | | | |
| Inne alternatywne sposoby na wydawanie | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| gotówki, a nie na inwestycje w badania i rozwój | | | | | | | |
| Wprowadzenie nowych kanałów dystrybucji | | | | | | | |
| Obiekt mojej firmy nie wymaga zwiększenia innowacyjności | | | | | | | |

## ROZDZIAŁ 3 - Źródła finansowania Twojej firmy

W tej części chcielibyśmy zbadać w jaki sposób firma uzyskuje dostęp do finansowania.

### 15. Od których źródeł finansowania jest Twoja firma najbardziej zależna?

| | 1 - nigdy | 2 - rzadko (u mniej niż 10% przypadków) | 3- Sporadycznie (w około 30% przypadków) | 4-czasem (w około 50% przypadków) | 5-często (w około 70% przypadków) | 6 - na ogół (w około 90% przypadków) | 7-zawsze |
|---|---|---|---|---|---|---|---|
| Finansowanie z banków komercyjnych | | | | | | | |
| Finansowanie z agencji rządowych | | | | | | | |
| Finansowania kapitału podwyższonego ryzyka (np. Venture Capital) | | | | | | | |
| Finansowanie ze środków własnych | | | | | | | |
| Inne proszę określić: | | | | | | | |

### 16. Jaki jest udział finansowania pomiędzy różnymi metodami finansowania w Twojej firmie?

| | 0%-10% | 10%-30% | 30%-50% | 50%-70% | 70%-100% |
|---|---|---|---|---|---|
| Finansowanie z banków komercyjnych? | □ | □ | □ | □ | □ |
| Finansowania z agencji rządowych | □ | □ | □ | □ | □ |
| Finansowania kapitału podwyższonego ryzyka (np. Venture Capital) | □ | □ | □ | □ | □ |
| Finansowanie ze środków własnych | □ | □ | □ | □ | □ |
| Inne proszę określić: | □ | □ | □ | □ | □ |

### 17. Jaki jest cel finansowania?

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Finansowanie działań krótkoterminowych | | | | | | | |
| Finansowanie wprowadzania nowych produktów | | | | | | | |
| Finansowanie zakupionej infrastruktury | | | | | | | |
| Finansowania wydatków na badania i rozwój | | | | | | | |
| Finansowanie innych innowacji | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Inne proszę określić: | | | | | | | |

## 18. Które metody finansowe są najbardziej efektywne do wspierania innowacji w Twojej firmie?

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Finansowanie ze środków własnych | | | | | | | |
| Finansowanie z banków komercyjnych | | | | | | | |
| Finansowanie kapitałem podwyższonego ryzyka (np. Venture Capital) | | | | | | | |
| Finansowanie z agencji rządowych | | | | | | | |
| Emisja akcji | | | | | | | |
| Inne proszę określić: | | | | | | | |

## 19. Co decyduje w jaki sposób finansować innowacje w Twojej firmie?

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Dostępność finansowania od banków komercyjnych | | | | | | | |
| Dostępność rządowych programów finansowania | | | | | | | |
| Dostępność środków własnych | | | | | | | |
| Zaufanie i empatia do instytucji które obecnie nas finansują | | | | | | | |
| Dostępność inwestorów Venture Capital | | | | | | | |
| Inne proszę określić: | | | | | | | |

**20. Jeśli korzystali Państwo z finansowania kapitałem podwyższonego ryzyka (tj. Venture Capital), jaki był jego wpływ na innowacje?**

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Innowacyjność nie zmieniła się | | | | | | | |
| Innowacyjność spadła | | | | | | | |
| Innowacyjność wzrosła | | | | | | | |
| Inwestor Venture Capital nie wspiera innowacyjności | | | | | | | |
| Inwestor Venture Capital koncentruje się na komercjalizacji istniejących innowacji w firmie | | | | | | | |
| Inne proszę określić: | | | | | | | |

## ROZDZIAŁ 4 – Jak Twoja firma współpracuje z innymi firmami

**21. Z jak wieloma dostawcami (np. towarów, informacji) współpracuje Twoja firma?**

| | 0-5 | 6-10 | 11-15 | 16-20 | 21-30 | > 30 |
|---|---|---|---|---|---|---|
| Proszę zaznaczyć liczbę | □ | □ | □ | □ | □ | □ |

**22. Z iloma odbiorcami (np. towarów, informacji) współpracuje Twoja firma?**

| | 0-5 | 6-10 | 11-15 | 16-20 | 21-30 | > 30 |
|---|---|---|---|---|---|---|
| Proszę zaznaczyć liczbę | □ | □ | □ | □ | □ | □ |

**23. Jaka część obrotów w Twojej firmie pochodziło ze sprzedaży do głównego nabywcy? (Proszę zaznaczyć jedną odpowiedź)**

□ 0-25% □ 26-50% □ 51-75% □ 76-100%

**24. Jaka część obrotów ze sprzedaży w Twojej firmie pochodziło ze sprzedaży do firm za granicą? (Proszę zaznaczyć jedną odpowiedź)**

□ 0-25% □ 26-50% □ 51-75% □ 76-100%

**25. Jaki jest zakres współpracy Twojej firmy z partnerami biznesowymi?**

| | 1 - nigdy | 2 - rzadko (u mniej niż 10% przypadków) | 3- Sporadycznie (w około 30% przypadków) | 4-czasem (w około 50% przypadków) | 5-często (w około 70% przypadków) | 6 - na ogół (w około 90% przypadków) | 7-zawsze |
|---|---|---|---|---|---|---|---|
| Poprawa jakości produktów | | | | | | | |
| Tworzenie nowych wzorów produktów | | | | | | | |
| Wymiana informacji / doświadczeń | | | | | | | |
| Marketing i dystrybucja produktów | | | | | | | |
| Organizacja produkcji | | | | | | | |
| Modernizacja technologiczna | | | | | | | |

## 26. Co dla Twojej firmy jest najważniejsze we współpracy z dostawcami?

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Poprawa jakości produktów | | | | | | | |
| Wymiana informacji / doświadczeń | | | | | | | |
| Poprawa czasu dostawy | | | | | | | |
| Szkolenia pracowników | | | | | | | |
| Organizacja produkcji | | | | | | | |
| Modernizacja technologiczna | | | | | | | |

## 27. Jak silna jest współpraca Twojej firmy z dostawcami

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Współpracujemy tylko z kilkoma kluczowymi dostawcami | | | | | | | |
| Staram y się mieć wielu dostawców | | | | | | | |
| Często szukamy nowych partnerów międzynarodowych | | | | | | | |
| Preferujemy mieć dłuższe i stabilne relacje dostawcami | | | | | | | |
| Wolimy mieć wielu różnych dostawców bez długoterminowych zobowiązań | | | | | | | |

## 28. Jak silna jest współpraca Twojej firmy z nabywcami

| | 1 – zdecydowanie się nie zgadzam | 2 – nie zgadzam się | 3- raczej się nie zgadzam | 4- neutralnie | 5- raczej się zgadzam | 6-zgadzam się | 7- zdecydowanie się zgadzam |
|---|---|---|---|---|---|---|---|
| Ograniczamy się do współpracy tylko z kilkoma kluczowymi nabywcami | | | | | | | |
| Staramy się mieć wielu nabywców | | | | | | | |
| Często szukamy nowych partnerów międzynarodowych | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Preferujemy mieć dłuższe i stabilne relacje z nabywcami | | | | | | | |
| Wolimy mieć wielu różnych nabywców bez zobowiązania długoterminowego | | | | | | | |

**29. Jaki jest stopień współpracy Twojej firmy z innymi firmami?**

**Niski poziom** → **Wysoki poziom**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Między Twoją firmą a firmami z tej samej branży | | | | | | | |
| Pomiędzy Twoją firmą a firmami z łańcucha dostaw | | | | | | | |

## ROZDZIAŁ 5

### o Tobie

Na koniec, chcielibyśmy zadać kilka ogólnych pytań o Tobie.

**30. Jaki jest Twój obecny tytuł w pracy?_____**

**31. W przybliżeniu, ile lat pracujesz w branży? _____**

Dziękujemy za poświęcenie czasu na wypełnienie kwestionariusza. Twoje odpowiedzi będą poufne i wszystkie wyniki będą agregowane co zapewnieni, że firma lub osoba wypełniająca nie może być w żaden sposób zidentyfikowana.

# Appendix 3: Survey (Czech Translation)

**TÉMA: Faktory ovlivňující inovativnost malých a středních podniků v Polsku a v České Republice**

Anketa má za úkol prozkoumat faktory, které ovlivňují schopnost inovace u malých a středních podniků ve Střední a Východní Evropě na základě příkladu Polska a Česka. Tento průzkum má za úkol stanovit vliv vztahů mezi různými faktory, jako je volba způsobu financování, vlastnické struktury a kooperačních vztahů na inovativnost malých a středních podniků v Polsku a v České Republice.

Výsledky průzkumu by měly poskytnout odpověď ohledně metod, které mají největší vliv na inovace v malých a středních podnicích v Polsku a v České Republice.

……

**Návod na vyplnění**

Dotazník by měly vyplnit osoby, které podnik řídí (např. výkonný ředitel / manager). Protože náš průzkum zahrnuje různé otázky týkající se působení firmy, označte prosím příslušné pole nebo dopište odpověď ručně. Zajímají nás všechny odpovědi, zašlete nám tedy prosím anketu i v případě, kdy nebude zcela dokončena. Průzkumy budou analyzovány v přísném utajení a pouze agregované výsledky budou zařazeny do finální dizertační práce. Názory osob nebo firem nebudou zpřístupněny. Vyplnění ankety potrvá cca 15 minut.

## KAPITOLA 1. - O Vaší firmě

Chtěli bychom začít tím, že Vám položíme několik otázek týkajících se Vaší firmy.

**1. Kdy byl firma založena?**

uveďte datum: ...

**2. Jaká je struktura vlastnictví Vaší firmy (označte jednu odpověď)**

□ rodinná společnost
□ společnost jedné osoby
□ frančíza
□ společnost závislá na společnosti s podílem zahraničního kapitálu
□ partnerství
□ jiné - uveďte:….

**3. K jaké branži patří Vaše firma?**

□ Výroba
□ Stavebnictví
□ Maloobchod a velkoobchod
□ Hotely a restaurace
□ Přeprava
□ Telekomunikace
□ Finanční služby
□ Zdravotní služby
□ jiné - uveďte:….

**4. Jaké je procento vlastnictví hlavního vlastníka ve Vaší firmě?**

□ <25%
□ 25-50%
□ 50
□ 50 - 75%
□ 75 - 100%
□ 100%

**5. Kolik zaměstnanců zaměstnává Vaše firma? (Označte jednu odpověď)**

□ Méně než 10 zaměstnanců
□ 10-49 zaměstnanců
□ 50-99 zaměstnanců
□ 100-149 zaměstnanců
□ 150 - 199 zaměstnanců
□ 200 - 250 zaměstnanců
□ více než 250 zaměstnanců

**6. Jaké faktory mají vliv na výsledky Vaší firmy?**

**Malý vliv** → **Velký vliv**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Inovativnost výrobku | | | | | | | |
| Inovativnost procesů | | | | | | | |
| Konkurence | | | | | | | |
| Expanze trhu | | | | | | | |
| Nové distribuční kanály | | | | | | | |
| Spolupráce s jinými firmami | | | | | | | |
| Marketing | | | | | | | |
| Přístup k financování | | | | | | | |

**7. Jak můžete popsat působení Vaší firmy?**

□ Poskytovatel služeb pro velké podniky (např. společné centrum služeb)
□ Subdodavatel (např. dodavatel výrobků pro velké závody)
□ Specializovaná (např. dodávání výrobků, které nejsou ekonomicky atraktivní pro větší firmy)
□ Inovativní (např. lídr na trhu s výrobky, které vyžadují velké investice, lidský kapitál)

## KAPITOLA 2. – Náklady na výzkum a vývoj

**8. Přibližně jaká část obratu Vaší firmy (nebo rozpočtu nebo času) byla určena na výzkum a vývoj (např. výrobku, procesu nebo projektu) během posledních pěti let? (Označte jednu možnost)**

□ 0% □ 1-5% □ 6-10% □ 11-20% □ 21-30% □Více než 30%

**9. Co je největší podporou pro inovace ve Vaší firmě?**

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Silná spolupráce s dodavateli | | | | | | | |
| Silná spolupráce s nabyvateli | | | | | | | |
| Mezinárodní spolupráce s dodavateli | | | | | | | |
| Mezinárodní spolupráce s nabyvateli | | | | | | | |
| Diverzifikovaná finanční základna (tj. více než 3 zdroje financování) | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Vzdělání personálu | | | | | | | |
| Více než 50% podílu v rukou hlavního vlastníka | | | | | | | |
| Přístup ke státním dotacím | | | | | | | |
| Přístup ke komerčním zdrojům financování (např. z banky) | | | | | | | |
| Přístup k financování rizikovým kapitálem (tj. Venture Capital) | | | | | | | |

**10. Jaká je přibližně úroveň vzdělání Vašich zaměstnanců?**

| | | | | | |
|---|---|---|---|---|---|
| Základní vzdělání | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Více než 30% |
| Středoškolské vzdělání | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Více než 30% |
| Vysokoškolské vzdělání | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Více než 30% |
| Postgraduální vzdělání (Dr., MBA, atp.) | □ 0% | □ 1-10% | □ 11-20% | □ 21-30% | □ Více než 30% |

**11. Uveďte na následujícím měřítku, do jaké míry Vaše firma uvedla nové řady výrobků, změny existujících výrobků a provedla změny ve svých výrobních procesech během posledních pěti let. (MĚŘÍTKO 1 -7, tedy 1 = Žádné, 7 = velmi mnoho, atd.).**

**Nízká úroveň ——— Vysoká úroveň**

| | Žádné 1 | 2 | 3 | 4 | 5 | 6 | Velmi mnoho 7 |
|---|---|---|---|---|---|---|---|
| Počet uvedení nových výrobků | □ | □ | □ | □ | □ | □ | □ |
| Počet změn / vylepšení existujících výrobků | □ | □ | □ | □ | □ | □ | □ |
| Počet nových zařízení / technologií zavedených ve výrobním procesu | □ | □ | □ | □ | □ | □ | □ |
| Nové vstupní materiály zaváděné ve výrobním procesu | □ | □ | □ | □ | □ | □ | □ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Počet organizačních změn / vylepšení ve výrobních procesech | □ | □ | □ | □ | □ | □ | □ |

## 12. Odpovězte, prosím, na následující otázky

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Často jsme první firma, která uvádí inovativní výrobky, nové služby a technologie | | | | | | | |
| Věnujeme více prostředků na výzkum a vývoj než konkurence | | | | | | | |
| Myslíme si, že naše firma je velmi konkurenceschopná vzhledem k agresivním cenovým strategiím | | | | | | | |
| Uvádíme na trh více nových výrobků než naši hlavní soupeři | | | | | | | |

## 13. Jak podporujete inovace ve Vaší firmě?

| | 1 - nikdy | 2 - zřídka (v méně než 10% případů) | 3-Sporadicky (ve cca 30% případů) | 4-někdy (ve cca 50% případů) | 5-často (ve cca 70% případů) | 6-Většinou (ve cca 90% případů) | 7-vždy |
|---|---|---|---|---|---|---|---|
| Prostřednictvím školení, seminářů | | | | | | | |
| Díky vládním dotacím pro zvýšení inovativnosti | | | | | | | |
| Prostřednictvím pravidelných pracovních skupin za účelem zlepšení procesů | | | | | | | |
| Prostřednictvím neustálých revizí organizační struktury | | | | | | | |
| Prostřednictvím účasti na konferencích, | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| pracovních panelech | | | | | | | |
| Prostřednictvím spolupráce s jinými firmami | | | | | | | |

## 14. Jaké byly nejtěžší výzvy při zavádění inovativních nápadů / výrobků ve Vaší firmě?

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Právní záležitosti (spojené např. s patenty) | | | | | | | |
| Vysoké investiční náklady na výzkum a vývoj | | | | | | | |
| Nejistota ohledně výsledků inovativnosti | | | | | | | |
| Jiné alternativní způsoby investování hotovosti než do průzkumu a vývoje | | | | | | | |
| Zavedení nových distribučních kanálů | | | | | | | |
| Objekt mé firmy nevyžaduje zvýšení inovativnosti | | | | | | | |

## KAPITOLA 3. - Zdroje financování Vaší firmy

V této části bychom chtěli prozkoumat jakým způsobem Vaše firma získává přístup k financování.

### 15. Na jakých zdrojích financování je Vaše firma nejvíce závislá?

| | 1 - nikdy | 2 - zřídka (v méně než 10% případů) | 3-Sporadicky (ve cca 30% případů) | 4-někdy (ve cca 50% případů) | 5-často (ve cca 70% případů) | 6-Většinou (ve cca 90% případů) | 7-vždy |
|---|---|---|---|---|---|---|---|
| Financování z komerčních bank | | | | | | | |
| Financování z vládních agentur | | | | | | | |
| Financování rizikovým kapitálem (např. Venture Capital) | | | | | | | |
| Financování z vlastních zdrojů | | | | | | | |
| Jiné - uveďte, prosím: | | | | | | | |

### 16. Jaký je podíl financování mezi různými metodami financování ve Vaší firmě?

| | 0%-10% | 10%-30% | 30%-50% | 50%-70% | 70%-100% |
|---|---|---|---|---|---|
| Financování z komerčních bank? | □ | □ | □ | □ | □ |
| Financování z vládních agentur | □ | □ | □ | □ | □ |
| Financování rizikovým kapitálem (např. Venture Capital) | □ | □ | □ | □ | □ |
| Financování z vlastních zdrojů | □ | □ | □ | □ | □ |
| Jiné - uveďte, prosím: | □ | □ | □ | □ | □ |

### 17. Jaký je účel financování?

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Financování krátkodobých aktivit | | | | | | | |
| Financování uvádění nových výrobků | | | | | | | |
| Financování zakoupené infrastruktury | | | | | | | |
| Financování výdajů na výzkum a vývoj | | | | | | | |
| Financování jiných inovací | | | | | | | |
| Jiné - uveďte, prosím: | | | | | | | |

## 18. Které finanční metody jsou nejefektivnější pro podporu inovací ve Vaší firmě?

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Financování z vlastních zdrojů | | | | | | | |
| Financování z komerčních bank | | | | | | | |
| Financování rizikovým kapitálem (např. Venture Capital) | | | | | | | |
| Financování z vládních agentur | | | | | | | |
| Vydání akcií | | | | | | | |
| Jiné - uveďte, prosím: | | | | | | | |

## 19. Co rozhoduje o tom, jakým způsobem jsou financovány inovace ve Vaší firmě?

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Dostupnost financování od komerčních bank | | | | | | | |
| Dostupnost vládních programů financování | | | | | | | |
| Dostupnost vlastních prostředků | | | | | | | |
| Důvěra a empatie vůči institucím, které nás financují aktuálně | | | | | | | |
| Dostupnost investorů Venture Capital | | | | | | | |
| Jiné - uveďte, prosím: | | | | | | | |

**20. Pokud jste využili financování rizikovým kapitálem (tedy Venture Capital), jaký byl jeho vliv na inovace?**

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6-souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Inovativnost se nezměnila | | | | | | | |
| Inovativnost klesla | | | | | | | |
| Inovativnost stoupla | | | | | | | |
| Investor Venture Capital nepodporuje inovativnost | | | | | | | |
| Investor Venture Capital se soustřeďuje na komercializaci existujících inovací ve firmě | | | | | | | |
| Jiné - uveďte, prosím: | | | | | | | |

## KAPITOLA 4. – Jak Vaše firma spolupracuje s jinými firmami

**21. S kolika dodavateli (např. zboží, informací) spolupracuje Vaše firma?**

| | 0-5 | 6-10 | 11-15 | 16-20 | 21-30 | > 30 |
|---|---|---|---|---|---|---|
| Označte číslo | □ | □ | □ | □ | □ | □ |

**22. S kolika odběrateli (např. zboží, informací) spolupracuje Vaše firma?**

| | 0-5 | 6-10 | 11-15 | 16-20 | 21-30 | > 30 |
|---|---|---|---|---|---|---|
| Označte číslo | □ | □ | □ | □ | □ | □ |

**23. Jaká část obratů ve Vaší firmě pocházela z prodeje hlavnímu nabyvateli? (Označte jednu odpověď)**

□ 0-25% □ 26-50% □ 51-75% □ 76-100%

**24. Jaká část obratů z prodeje ve Vaší firmě pocházela z prodeje zahraničním firmám? (Označte jednu odpověď)**

□ 0-25% □ 26-50% □ 51-75% □ 76-100%

## 25. Jaký je rozsah spolupráce Vaší firmy s obchodními partnery?

| | 1 - nikdy | 2 - zřídka (v méně než 10% případů) | 3- Sporadicky (ve cca 30% případů) | 4-někdy (ve cca 50% případů) | 5-často (ve cca 70% případů) | 6-většinou (ve cca 90% případů) | 7-vždy |
|---|---|---|---|---|---|---|---|
| Zlepšení kvality výrobků | | | | | | | |
| Vytváření nových vzorů výrobků | | | | | | | |
| Výměna informací / zkušeností | | | | | | | |
| Marketing a distribuce výrobků | | | | | | | |
| Organizace výroby | | | | | | | |
| Technologická modernizace | | | | | | | |

## 26. Co je pro Vaši firmu nejdůležitější během spolupráce s dodavateli?

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6- souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Zlepšení kvality výrobků | | | | | | | |
| Výměna informací / zkušeností | | | | | | | |
| Zlepšení doby dodání | | | | | | | |
| Školení zaměstnanců | | | | | | | |
| Organizace výroby | | | | | | | |
| Technologická modernizace | | | | | | | |

## 27. Jak silná je spolupráce Vaší firmy s dodavateli

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6- souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Spolupracujeme pouze s několika klíčovými dodavateli | | | | | | | |
| Snažíme se mít mnoho dodavatelů | | | | | | | |
| Často hledáme nové mezinárodní partnery | | | | | | | |
| Upřednostňujeme delší a stabilní vztahy s dodavateli | | | | | | | |
| Raději máme více různých dodavatelů | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| bez dlouhodobých závazků | | | | | | | |

**28. Jak silná je spolupráce Vaší firmy s nabyvateli**

| | 1 – rozhodně nesouhlasím | 2 – nesouhlasím | 3- spíše nesouhlasím | 4- neutrální | 5- spíše souhlasím | 6- souhlasím | 7-rozhodně souhlasím |
|---|---|---|---|---|---|---|---|
| Omezujeme se pouze na spolupráci s několika klíčovými nabyvateli | | | | | | | |
| Snažíme se mít mnoho nabyvatelů | | | | | | | |
| Často hledáme nové mezinárodní partnery | | | | | | | |
| Upřednostňujeme delší a stabilní vztahy s nabyvateli | | | | | | | |
| Raději máme více různých nabyvatelů bez dlouhodobých závazků | | | | | | | |

**29. jaká je úroveň spolupráce Vaší firmy s jinými firmami?**

**Nízká úroveň** → **Vysoká úroveň**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Mezi Vaší firmou a firmami ze stejné branže | | | | | | | |
| Mezi Vaší firmou a firmami z dodavatelského řetězce | | | | | | | |

## KAPITOLA 5.

### o Vás

Nakonec bychom Vám chtěli položit několik obecných otázek, které se týkají přímo Vás.

**30. Jaký je Váš aktuální titul v zaměstnání? _____**

**31. Přibližně kolik let pracujete v branži? _____**

Děkujeme, že jste věnoval/a čas na vyplnění dotazníku. Vaše odpovědi budou důvěrné a všechny výsledky budou agregovány, takže bude zajištěno, že firma nebo vyplňující osoba nemůže být nijak identifikována.

*Intentionally blank*